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CONGRESSES.

The Congress season at the Paris Exposition is now at its height, and we give elsewhere some details from our special correspondent as to one of the most notable of the meetings, the Physical Congress. It would appear that, viewed with respect to the programme, number of members inscribed or attendance, this is a gratifying success. Almost 1000 names have been inscribed, the attendance at the opening session exceeded 500, and the papers will form a contribution of unique importance to physical science, the authors being almost entirely from among the masters of that branch of learning.

As to the International Electrical Congress, we are informed from Paris that almost 1000 names have already been inscribed on its roll. Judging from the large number of adhesions given in during the several days immediately preceding such affairs, it would not be a matter of surprise if the list ran up to between 1200 and 1500 members. This is but another evidence of the fact that an international exposition is a good centre around which to organize these meetings. The industrial importance of expositions tends to dwindle, at least, does not increase, but their scientific importance is to-day greater than ever.

MUNICIPALISM.

We have endeavored from time to time to indicate the dangers that underlie the present movement for municipal ownership and operation of what are known as "public utilities." Those who advocate these things or agitate for them are not able to see that the change cannot stop short at an electric light plant or a water works, but in due time will hit their own little industry as well. Perhaps the programme of the Social Progress League, formed by a number of representatives of labor unions, will serve to enlighten them. If it stopped at 3-cent car fares, why nobody would kick, except the unfortunate investor in street railway securities, but it goes much further than that. It demands municipal coal yards. It demands municipal drug stores. It demands municipal pawnshops. It demands municipal savings banks. It demand municipal life insurance. It demands "other municipal agencies for poor people," which presumably means bakeries, clothing stores and factories, grocery stores and beer saloons. Moreover, it demands the abolition of the contract system for municipal work and immediate municipal employment for everybody out of a job. In other words, it is thoroughly logical from start to finish in its fight against enterprise, individualism, initiative and a low tax rate.

FAN MOTORS FOR EXPORT.

Consul Halstead, at Birmingham, England, reports that the recent hot weather in London has created a demand for fan motors. He says, however, that he has never seen an electric fan in England, and "wonders why our manufacturers in this line neglect their opportunity." The remark is a little hard on the aforesaid manufacturers. They are not neglecting their opportunity—at least, some are not—and many of their fans are to be found in England, although so rarely that Mr. Halstead may not have seen them. There is an old saying about inability to make a horse drink if he does not elect to drink, and while one may stand ready to sell electric fans to the Britishers you cannot well force them on so sturdy a Chinaman as John Bull is.

The general attitude toward a "draft," in Europe, is well exemplified by a recent report from Switzerland. One of the factory inspectors there relates an anecdote about the attitude of the operatives in a certain factory in regard to an improved ventilating apparatus. They objected to it strenuously because it would breed rheumatism. Two years later the same laborers have refused to go into another building because it lacked that same ventilating apparatus.

Conditions are parallel in regard to the ventilating fan motor in England, France, etc. Once the prejudice is overcome, things are easier, but it is the first fan that costs. Not long ago, some American electrical manufacturers in France were threatened with a serious strike because in building a new factory they put in sash-weight windows, on account of their better light and ventilation and other qualities. The employees all swore they would not work in a factory where they were subjected to the perils of "fenêtres à la guillotine" (guillotine windows) every time they popped their heads out to see what was going on in the street. The guillotine windows are in, and are quite popular, but the incident, like that in Switzerland, shows that while you may also have fan motors ready, every man who needs them does not become at once an enthusiastic purchaser. He would rather ofttimes perish in his perspiration.

A WASTEFUL CENTURY.

There are many things for which the century now closing will be distinguished. Mr. Arthur Balfour, the English Conservative leader, in a recent address at Cambridge University, remarked that he thought the most fundamental difference separating the present from past ages would be found in the cumulative products of scientific research. While he admitted that there might have been in the past hundred years no discovery equal to that of Copernicus, and no discoverer like Newton, yet his opinion seems to be that in their total effects the scientific advances of the nineteenth century are not to be matched.

Nevertheless the century has been one of the most unscientific on account of its wastefulness, and Mr. Balfour in passing from science to industry, came to speak very naturally of Watt. It is true we have a wonderful mechanism in the steam engine, but the original device was extravagant and the gains are still so small since the days of that inventor as to leave the engine open to the reproach of being a wasteful machine. But it is not alone its supplies of coal the world has been wasting. England is at her limit as to fuel, and American coal supplies must now reinforce hers; but in this country we have been frightfully wasteful also of our forests, our oil, our natural gas, our resources of virgin soil. The world, indeed, has never seen such wastefulness as that of America these hundred years. It is in processes of economy that even on this boundless continent the chief sources of new wealth must be found in the next century, with electricity probably as the main agent. Thus is it that the reclamation electrically of so many idle water powers has already been effected. Another means will consist doubtless in the abolition of the existing millions of small fires and furnaces and the distribution of all light, heat and power from central plants of electricity and gas. Mr. Balfour yearns to see another Watt arise, but it is to be feared that so far as the steam engine is concerned, there are no longer possible radical inventions and improvements, but only small gains and minute progressive economies. Nor is that true of the steam engine alone, on the general question of higher obtainable efficiencies. It is pitiful to think of the waste in a gas stove or an incandescent lamp, waste that appears more or less unavoidable.

STREET ILLUMINATION.

The Ohio Electric Light Association is a useful organization, whose meetings each year are interesting and well attended. Some of the papers are so good, they deserve presentation before a national body, yet the authors are modestly satisfied with an audience from among their fellow-workers in the State. It is rather curious there are not more of these local bodies. At one time a number of them were planned and actually set going, but to-day only two or three exist vigorously. A meeting twice a year is not very exacting in its demands on time, and as the National Electric Light Association meets now but once a year, the State associations could easily meet, as does that of Ohio, in the off season.

Our report of the convention summarizes the papers and discussions, all of which appear to have been excellent. One of the papers of most concrete value is that of Mr. W. F. White, of the Cincinnati Edison Company, treating of the results of street illumination with gas and electricity. As it has been put into pamphlet form, we would advise our readers to get copies, for study or distribution. The deplorable fact has recently been noted in our columns that some gas managers have been making a vicious attack on electricity, and Mr. White's figures come in time to correct many of the erroneous ideas that have thus been given malicious circulation. Our view of the matter has been that such a style of warfare was out of date, and a correspondent points out this week that some of these gas people are now squabbling among themselves over the relative dangers and deadliness of acetylene and gasoline; so that they might well be left to a Kilkenny struggle for mutual extermination. Still, it is just as well to have the data in hand showing how unfair are the assaults on electricity, and in this respect Mr. White has done his work admirably.

The "heads of discourse" in Mr. White's paper are very striking. As to the use of electricity in street lighting, he shows that out of 121 cities heard from, 69 are using electric light exclusively, and in all of the 160 cities over 25,000 population, it is used either wholly or in part. St. Louis is the only city where gas has replaced electricity in part, and the politics of that little piece of business are given. To sum up, 60 per cent of all the cities are electrical and the other 40 per cent are rapidly becoming so. As a showing for only 21 years of effort and advance this is not merely encouraging but pretty conclusive as to public opinion.

We have had many inquiries from time to time as to the use of Welsbach burners on the streets, their number and the quality and quantity of light they give. Mr. White goes into that subject quite thoroughly, and he cites data in proof of the statement that one arc of 800 actual useful candle-power will give as much light as 20 Welsbachs of 40 actual useful candle-power. This he supplements by photographs of streets lighted by the two methods, and he also goes into the question of relative cost. The contrast between the street lit by arcs at $641.56 per mile of street per year, and the street lit by Welsbachs at a cost of $1,044.40 per mile of street per year, is simply startling. As to the correctness of the relative costs, the figures from Chicago, given officially, show $784.60 for gas lighting per mile and $567.45 for electricity. As to the photographs, it may be mentioned that while those for the arcs were exposed 12 minutes, it took 22 minutes with the gas pictures to get them with any kind of decent detail for the surroundings. This is not surprising, but it is surprisng that at this late day a campaign should be started to offset such facts by giving out sensational and alarming data as to the alleged dangers of electricity. Mr. White does a public service when he proves that electric lighting has so much in its favor, but he does an equal service

when he urges all who are interested in the operation of plants to adopt improved methods and keep up the efficiency of their equipment.

SUGGESTIONS ON WIRELESS TELEGRAPHY.

We are glad to note that our suggestions on wireless telegraphy have awakened some of its exponents to its defence. It was far from our purpose, however, to pass any hostile criticism upon the system. It is one of those inventions which promise great things in its own special sphere, but for its rapid and effective development, results are needed, and that speedily. Perhaps, as a correspondent suggested last week, the termination of the South African campaign will bring to light some interesting reports, if they are not pigeonholed in the War Office, but the reports from the field which have thus far leaked out are very meagre. Meanwhile, what attention is our own Signal Corps giving in the premises? It certainly possesses a number of officers, including its distinguished chief, of high scientific ability, amply competent to work the system for everything there may be in it, and the public certainly should be assured that due diligence is being exercised by them. If they are hampered by lack of men or of means, the responsibility is merely passed to their superiors. Here is an invention that offers an opportunity, at least, for securing means of military communication enormously more useful than any existing system. The apparatus is far from complicated, and not necessarily either very bulky or heavy. It can, apparently, work in all weathers, and in utter disregard of ordinary obstacles, over distances quite comparable with those within practicable range of heliographing. Now, if these claims are substantiated, the system becomes for military purposes of the very first order of importance. Von Moltke's famous maxim: "March apart; fight together," is the keynote of modern strategy, but the forces in South Africa, even under the astute command of Lord Roberts, and possessing ten sets of Marconi instruments, seems for the most part to have followed out only the first section of the great German's programme. Of course, wireless telegraphy cannot be blamed for this, since even elementary matters like scouting were often sadly neglected in the Cuban and Transvaal campaigns, but may not some of the trouble be due to an attempt on the part of the wireless telegraphers to do too much?

To be of real service a wireless telegraphic outfit should not go to the front with the siege train, but with the cavalry screen. Very powerful and sensitive apparatus fitted for long-range communication is by no means essential for this service. The desideratum is a light and compact kit that can be carried by a couple of troopers and put into action in a few minutes, even while the rest of the squadron is standing off the enemy. An effective working radius of 15 or 20 miles would generally prove quite sufficient, and even less would answer to tide over many an emergency. Perhaps for this field service something better than the ordinary receiver can be devised—less complete, maybe, but simpler for use in rough service and sufficiently sensitive for the purpose. On the advance line such an instrument would carry news promptly to the main body, and enable an alarm to be carried quickly along the front. In camp, or at division headquarters, more elaborate outfits would be valuable for holding communication front or rear, but the essential thing is the highest possible degree of portability consistent with effective work over moderate distances. This is the problem for the inventor, and for the rest it is time to call upon the War Department to meet him half way. In the military service, it has too long been the fashion to fore-damn anything and everything devised by civilians, a policy fostered of the importunities of long-haired gentlemen with schemes, but always hazardous and frequently unwise. The material of war to-day is not merely "villainous saltpetre" and cold steel—it is part and parcel of modern science, and the maker and the user should join hands.

ELECTRICITY IN OUR COAST DEFENCES.

In connection with the editorial discussion of wireless telegraphy, preceding, it is pertinent to refer to some of the conditions which existed during the late fracas with Spain, and which have not since been much ameliorated. The United States alone of the great nations has committed itself to the extensive use of high-power mortars. It is not our purpose or our province here to discuss the merits and demerits of these weapons; suffice it to say that they are capable of much greater precision of fire than the layman would be inclined to attribute to them, and that by common consent an 850-pound shell chock full of joveite is a decidedly disagreeable thing to have dropped in one's immediate vicinity. But a mortar has a trajectory curve much like a rainbow, and for efficiency of fire the position of the target must be known with great exactness. Not only this, but a moving target must be followed so closely as to predict where it will be when the projectile falls at the end of half a minute or so of flight. Now, it is a solmen fact that most of Uncle Sam's mortars were two years ago quite destitute of means for locating the position of an enemy within a five-acre lot. More than this, the big guns were likewise innocent of any facilities for accurate indirect fire, to say nothing of the lack of ammunition, which has since been remedied. Now there have been before the Bureau of Ordnance in the past few years several range-finders of a highly-ingenious and promising character, which have been given the cold shoulder. Within its field of usefulness the present service depression range-finder is most serviceable, but it is very far from answering all the requirements, and something better is badly needed—a policy of encouraging, not suppressing, inventions which, even if still in an experimental stage, seem capable of adding to our resources for national defence. Even if the more refined instruments sometimes break down, as did the navy range-finders at Santiago, the cruder apparatus is at hand to supplement them, and it is by no means improbable that the very range-finders that failed in the rack of battle had done their service in training the men who pointed the guns.

Even in direct firing the artillerist may well call on the electrician for aid. The statistics of recent naval actions show, amid a mass of tangled testimony, one thing very clearly. Guns up to and including the six-pounder scored an enormously greater percentage of hits than those of larger calibre. They are not intrinsically more accurate, nor have they any more stable gun platform, but the six-pounder was the largest piece pointed and fired from the shoulder. And thus following the motion of the ship and target, many a projectile got home that would have gone wide while the gunner was juggling with his elevating and training gear. In all practice at moving targets quick and easy alignment of the sights is absolutely necessary to make good shooting, and our big coast defense guns are seriously lacking in this quality. It should be a very easy matter to adapt to them motor gear that would enable a moving ship to be followed with the greatest precision from the firing platform, so that a thirty-pound gun could be trained with almost the ease of a one-pounder. The turrets of some of the new battleships are already equipped with wonderfully effective apparatus of this kind, but we have not heard that the army has followed the example of the navy in this respect. Yet here is an opportunity for prodigious increase of efficiency, and the way is already open. These are times when the Ship of State had better cruise cleared for action lest another war shall find it as did the last, with too many of the stores ashore. It does not pay to let things slide when the urgent necessity is past, either, for the country has not yet caught up with the game of war as it is played to-day, however gallant may be the personnel of the service. If China, for example, should insist on breaking up, for easier absorption, some serious work might at once be cut out, whether we liked it or not.

International Physical Congress.

(From our Special Correspondent.)

The International Physical Congress (Congrès Internationale de Physique) was opened at 3 p. m., Aug. 6, in the Palais des Congrès in the Paris Exposition grounds, President Cornu, of the committee of organization in the chair. In opening the congress he referred to the excellent work of the secretaries of the committee of organization—MM. Guillaume and L. Poincaré—a commendation well deserved, in view of the excellent programme placed before the congress, the preparation of which was largely their work. The proposed work of the congress was sketched, and the proposal that Lord Kelvin be named honorary president was carried with much applause.

A. CORNU.

Prof. Warburg, imperial delegate from Germany, replied to the address of M. Cornu, and proposed that he be named as permanent president of the congress, which motion was carried with applause. The suggestion of the committee of organization as to the permanent organization of the congress was then adopted.

CH. ED. GUILLAUME.

The seats on the platform to the rear of President Cornu and Lord Kelvin were occupied by official delegates to the congress among whom were A. Graham Bell, Major John Millis, U. S. A., and Prof. Cleveland Abbe, representing the United States Government; Prof. Arthur G. Webster, representing the American Physical Society, and Mr. Carl Hering, representing the Franklin Institute. Among the members of the congress seated in the body of the hall were Prof. Morley, of Case Institute, Cleveland, Ohio, and Prof. Langley, of Smithsonian Institute.

The general officers of the congress as thus fixed are as follows: Honorary president, Lord Kelvin; president, M. Cornu; French vice-presidents, MM. Cailletet and H. Poincaré; foreign vice-presidents, A. Graham Bell, United States; Sir W. Roberts-Austen, England; M. Schivedoff, Russia; M. Warburg, Germany; M. Vanderwaals, Holland; M. Exner, Austria; M. Righi, Italy. General secretaries, MM. Lucien Poincaré and Ch. Ed. Guillaume. Secretaries of sections, MM. Abraham and Raveau, France; M. Du Bois, Holland; M. Lebeden, Russia; M. Nagaoka, Japan, and M. Hurmuzescu, Roumania.

The organization of the congress comprises seven sections, as follows: Section I—General questions, measures, units and teachings. Section II—Mechanical and molecular physics. Section III—Optics and thermodynamics. Section IV—Electricity and magnetism. Section V—Magneto-optics, cathode and uranium rays, etc. Section VI—Cosmical physics. Section VII—Biological physics.

Each section is provided with a president, one French and two foreign vice-presidents and two secretaries. The presidents in order of the sections are: MM. Benoit, Violle, Lippmann, Potier, Becquerel, Mascart and Charpentier. The only American among the vice-presidents is Prof. Cleveland Abbe, of the United States Weather Bureau, who was assigned to the section on cosmical physics, presided over by Prof. Mascart. Among the secretaries is Madame Curie, well known for her work with radio-active substances.

The programme includes 78 papers, which will, when bound, form three portly volumes. The distribution of papers is as follows: Section I, 15; Section II, 16; Section III, 12; Section IV, 16; Section V, 7; Section VI, 7; Section VII, 5. As will be seen, the section of electricity and magnetism divides honors with that of mechanical and molecular physics with respect to the number of papers, but there should be added to the list of electrical papers those classified in other sections, and numbering 7—thus placing electricity far in the lead.

Of a number of important papers on the programme, two are of the highest interest—one by Prof. H. Poincaré and the other by Lord Kelvin. The former deals with the philosophy and methods of physical science, and promises to take a high permanent rank in the literature of the subject. The other deals with the ether hypothesis, and presents yet another modification to meet some of the objections to the hypothesis as applied to the undulatory theory of light.

The sittings of the several sections will be held simultaneously on mornings from Tuesday to Saturday, Aug. 6-11, at the rooms of the Société de Physique, 44 rue de Rennes, except Section VII, which will meet the same mornings in the Ecole de Médicine. On the afternoon of Tuesday a general meeting will be held to hear the remarkable paper of M. Poincaré on "The Relations Between Experimental and Mathematical Physics." On Wednesday afternoon Section V will meet at the Museum of Natural History to witness experiments by M. H. Becquerel and Madame Curie on radio-active bodies. On Thursday afternoon M. Cornu will lecture before all sections in the Ecole Polytechnique on the velocity of light, showing the apparatus of Fizeau and Foucault. The same evening members of the congress may visit the Palais de l'Optique, one of the notable side attractions of the Exposition (already illustrated and described in the ELECTRICAL WORLD AND ENGINEER) free of charge. On Friday afternoon the congress will visit the laboratories of the Sorbonne, and there witness some experiments by Profs. Bouty and Lippmann.

Two notable social features will be a reception by the president of the French Republic on Friday at the Palais de l'Elysee of the members of the congress, and a reception on Saturday by Prince Roland Bonaparte, at which a number of physical experiments will be shown.

Owing to the admirable organization of the congress, for which high credit is due to President Cornu and Secretaries Guillaume and Poincaré, the programme up to the date of this writing (Friday, Aug. 10) has been enabled to be carried out no less admirably. Of almost 40 papers dealing in whole or in part with electrical subjects, all are in type except two, and the division of the congress into seven sections will give ample time for the fourscore papers to be read and discussed.

The discussion of Prof. Guillaume's paper, "Units of Measure," which was to be general in character and include consideration of a number of propositions relating to units, notation and nomenclature, was commenced on Thursday. It soon became apparent, however, that in order to accomplish anything the various propositions should be brought before the congress in some kind of order. For this purpose a committee was therefore appointed, with instructions to report recommendations based upon the various propositions brought before it. This committee consisted of the following official delegates to the congress: United States,

LUCIEN POINCARÉ.

Prof. A. G. Webster; England, Prof. Gladstone and H. Vernon-Boys; Germany, Kayser, Thiesen and Rydberg; Italy, Batteli and Grimaldi; Russia, Rykatcheff and Galitzene; Austria, Pfaundler; Belgium, Spring; Japan, Nagaoka; France, Guillaume, Benoit, Lopinay, Poincaré, Bouty, Hospitalier, Pellat and Sarrau. The sessions of the committee were open to those having propositions to present, and Prof. Langley was requested to attend in view of a proposition to be presented on a unit of radiation. The representative of the ELECTRICAL WORLD AND ENGINEER was also invited to attend the sessions.

E. MASCART.

We are indebted to the secretaries of the congress, MM. Guillaume and Poincaré, and to Gauthier-Villars for advance proofs of the papers to be read.

The Electrical Equipment at the Indian Head Naval Proving Grounds.

EARLY this year the United States Navy Department began the manufacture of smokeless powder at its new and extensive works at Indian Head. About six square miles of the lowlands of the Potomac, far away from the busy haunts of men, have been transformed for the production and proving of warlike material. Work upon the new buildings has been steadily in progress for nearly two years, and they are now equipped with machinery, and about 1200 men are employed. Altogether the buildings will number 24 or 25, the greater part of which are completed, having a capacity of 2000 lbs. of smokeless powder daily. Admiral O'Neil, chief of the Bureau of Ordnance, accompanied by Lieutenant Seymour, of the same Bureau, recently inspected the work, and was much pleased at the fine appearance of the buildings and at the progress that had been made.

The various sections of the power plant cover a wide area about four miles back from the Potomac. The general purpose has been to separate the buildings as much as the requirements of manufacture would permit, in order to minimize the risks of explosion. For this reason there are no large central works, but many small ones apart from each other, each embodying a distinct branch of the powder manufacture. The buildings are arranged also with a care for prevailing winds, so that the risk of acid fumes being borne by the wind to other buildings is reduced to a minimum. One building is devoted exclusively to the picking process, another to the mixing, and another for the acids, and so on through every branch of the work. Another precautionary measure has been the construction of light "paper' walls at the ends of the buildings. These readily give way to the pressure of an explosion, leaving the main walls of the structure standing and materially reducing the loss which occurs when an explosion takes place among closely packed buildings, and where there is no exit for the suddenly loosened force. Electricity has been utilized to a large extent at the powder works. A complete trolley car service is in operation to connect the main buildings and allow the products to be carried expeditiously from point to point. By this means the material, in its various stages, is kept moving from building to building until completed. The electric plant serves the threefold purpose of operating the machinery, running the trolley car service from mill to mill, and supplying light over the broad extent of the whole plant.

The central power station, the interior of which is shown in Fig. 1, is a substantial brick building with steel truss roof, the boiler and engine rooms being divided by a partition wall. There are three generating units, two 250-kw A. C. D. C., and one 75-kw A. C. generator, supplied by the Westinghouse Electric & Manufacturing Company. Each of these machines is direct connected to its own engine. The engines for the two larger generators are 20 ins. x 34 ins. x 16 ins., rated at 500 horse-power each, and one 12 ins. x 20 ins. x 12 ins., rated at 150 horse-power. These engines are compound, enclosed type, built by the Westinghouse Machine Company, East Pittsburg. The 250-kw generators deliver current simultaneously from both sides; from the commutator, direct current at 550 volts, and from the collector rings, two-phase alternating current at approximately 400 volts, 3600 alternations. The 75-kw generator is single current, delivering two-phase alternating of the same voltage and frequency as the A. C. side of the larger generators. The exciters, 7½-kw, of the standard Westinghouse type, are driven by the engine to which each of the main generators is direct connected, as seen in the illustrations. In the generating station is a transformer of 18¾ kilowatts capacity, for stepping-up the A. C. current to 1100 volts, to supply a feeder line for lighting buildings adjacent to, but outside the proving grounds.

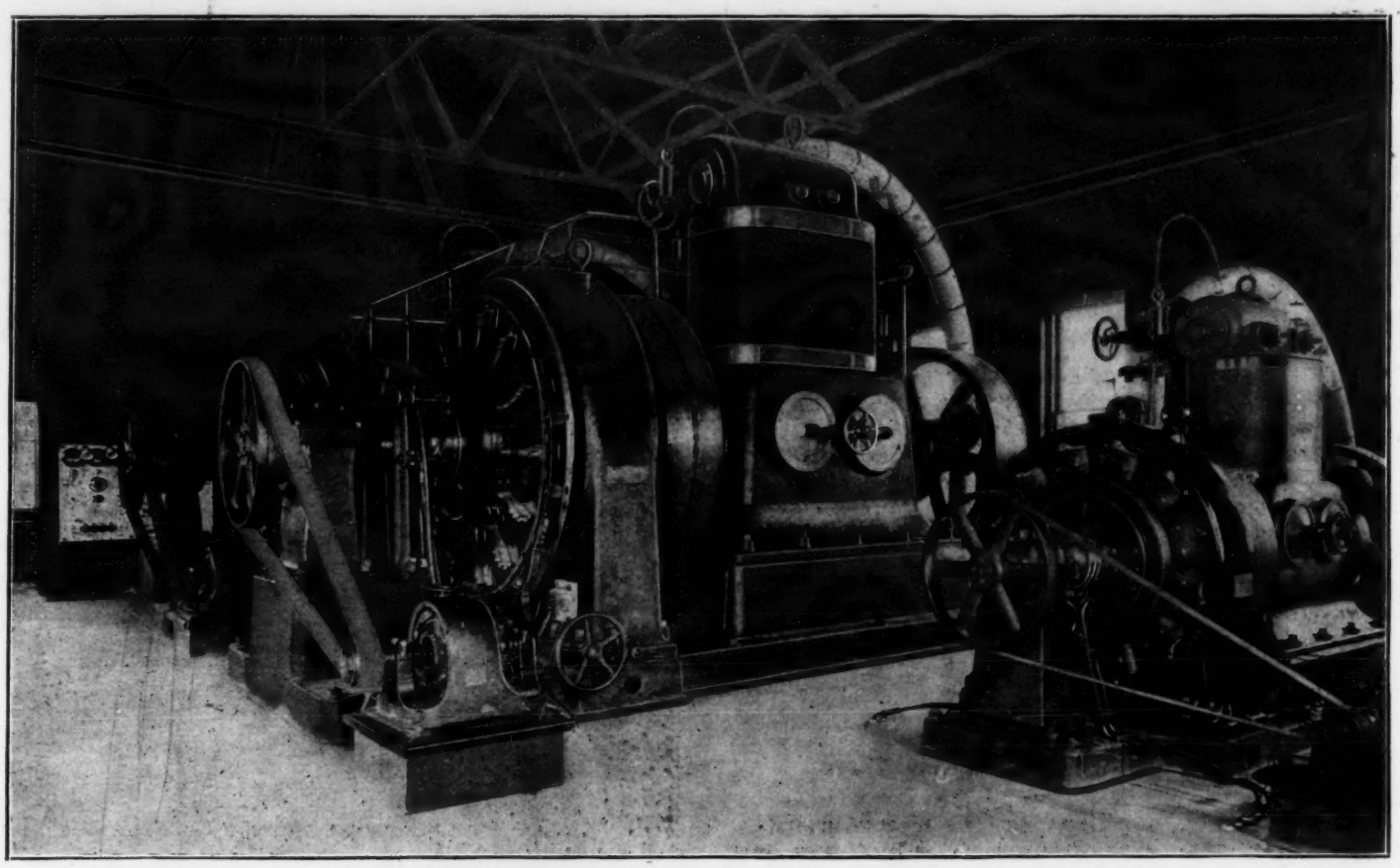


FIG. 1.—POWER PLANT, INDIAN HEAD PROVING GROUNDS.

This electrical equipment is probably one of the most flexible ever designed. The load is constantly varying, not only in amount but also in the character of the current. The trolley system is supplied from the direct current side of the generators; the lighting system from the A. C. side of the two larger generators, and by the 75-kw machine, and power is taken from the alternating current circuits for a number of Westinghouse type "C" induction motors, which operate the machinery in the different departments of the works. For this extremely varied service, the double current generators are peculiarly adapted, as they will deliver their full load in either direct current or alternating current as may be required, or will divide the load between the two currents in any proportion. The units are thus enabled to operate at their highest efficiency and supply every call made upon them. The two double current generators are run in multiple with each other at either of their A. C. or D. C. sides, and either of them can be run in multiple with the 75-kw A. C. generator. The latter may be used as auxiliary to either of the larger generators for supplying power to the powder mills, or may be used alone for light loads in supplying light and power, or both. Usually one of the

larger generators, aided by the 75-kw machine, is able to carry the ordinary demands upon the plant for the day service, the two having sufficient capacity to operate the stationary motors, a crane motor in the proving grounds, and one locomotive upon the trolley system. Alternating current is also provided for lighting the various mills, offices and houses. Any or all of the generator fields may be fed from either or both of the 7½-kw exciters, which can be run separately or in multiple. The 1.87-kw exciter can be used for exciting the 75-kw generator only, the latter being separately excited. The A. C. D. C. generators are provided with series fields as well as separately ex-

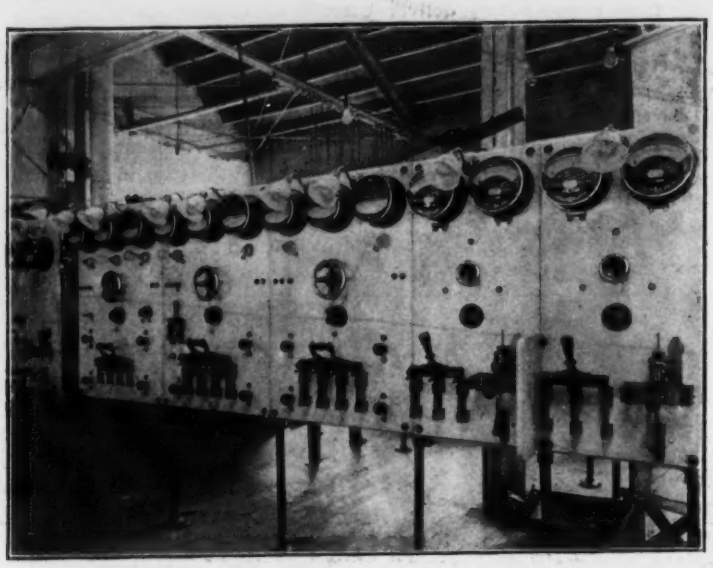


FIG. 2.—FRONT OF SWITCHBOARD.

cited fields. These series fields compensate for the drop caused by their D. C. current, but do not interfere with running the double current generators and the 75-kw generator in parallel.

The switchboard, Figs. 2 and 3, consists of five panels, one for the D. C. side of each of the 250-kw generators, and one for the A. C. side of each of the same, and one panel for the 75-kw A. C. generator.

The 75-kw generator panel has two ammeters, one in each phase, an A. C. voltmeter with plug and receptacle, so that the voltmeter can be thrown on either of the two phases; also a combination rheostat with two concentric hand wheels on the front, to control the generator and its exciter. There are four field plugs, three connected to the positive side of the three exciters, and the fourth to the negative side of the field, so that the generator field may be connected to any one or all three of the exciters. The other panels are correspondingly equipped.

Motive power is supplied to the various sections of the powder works, as stated above, by Westinghouse type "C" induction motors, which are particularly satisfactory in this work, as, having no moving contacts, brushes or commutators, sparking cannot occur, and they can be operated with safety in the presence of gunpowder or other explosive or inflammable material. Separate motors are used to drive the nitre grinding machines. The nitro-glycerine mixers are operated by other motors, as well as the centrifugal wringers in the cotton plant, which wring the surplus acid out of the hank cotton or from the raw gun cotton. The pulpers are direct connected to electric motors, and the shafting in the carpenter and machine shops is driven in a similar way. Ventilating fans and the machinery at the gun cotton plant are also operated by motors, all of which are two-phase, 400 volts, 3600 alternations, taking power direct from the generators.

In connection with this work, the Westinghouse electromagnetic surface contact traction system has been adopted for part of an electric railway which traverses the proving grounds for transporting material three or four miles between the dock and the powder mills. The overhead wire trolley is used for the two ends of the line, but part of the track, for rather over half a mile, crosses the line of the gun ranges, where overhead wires would be in constant danger from projectiles and from flying fragments, and for this portion the electromagnetic system with its surface contacts has been applied. The essential elements of the system are the following: First—Electromagnetic switches enclosed in moisture-proof iron cases, each switch being permanently connected to the positive main or feeder which is laid parallel to the track. Second—Cast-iron contact plates or buttons, two in each group, placed between the rails and connected electrically to the switches. A separate switch is provided for each group of buttons. Third—The conductor forming the postive main or feeder, which is completely enclosed in a wrought-iron pipe and is connected to the various switches. Fourth—Two metal contact shoes or bars on each car, suspended from the car trucks. Fifth—a small storage battery upon the car.

The operation will be readily understood by reference to Figs. 4 and 5, which give diagrams of the line or track connections, and the car connections. Electromagnetic switches, X_1, X_2, X_3, enclosed in water-tight casings, are installed at intervals of about 15 ft. along the track. Each switch is provided with two windings, shunt and series, I and H, which are connected by the wires N and M to two cast-iron contact buttons, 1 and 2, which are mounted on insulators and placed between the rails, almost flush with the surface of the roadway. Each car has two contact bars, Q_1 and Q_2, shown in Fig. 2, made of steel tees and mounted on springs. The car has also a few cells of storage battery, and the usual equipment of motors and controllers. The contact bars are mounted at the same distance apart as the two rows of contact plates, and as the cars advance the bars will always be in contact with at least one pair of the plates, as the length of the bars is greater than the longitudinal distance between the plates.

If a car is standing on the line over the switch X_2, the contact bars Q_1 and Q_2, being then in connection with the buttons 1 and 2 respectively, the first step is to "pick up" the current, or to render the plates alive. Switch A is first closed, which completes the circuit from the storage battery D, through the wiring R, contact shoe Q_1, button No.

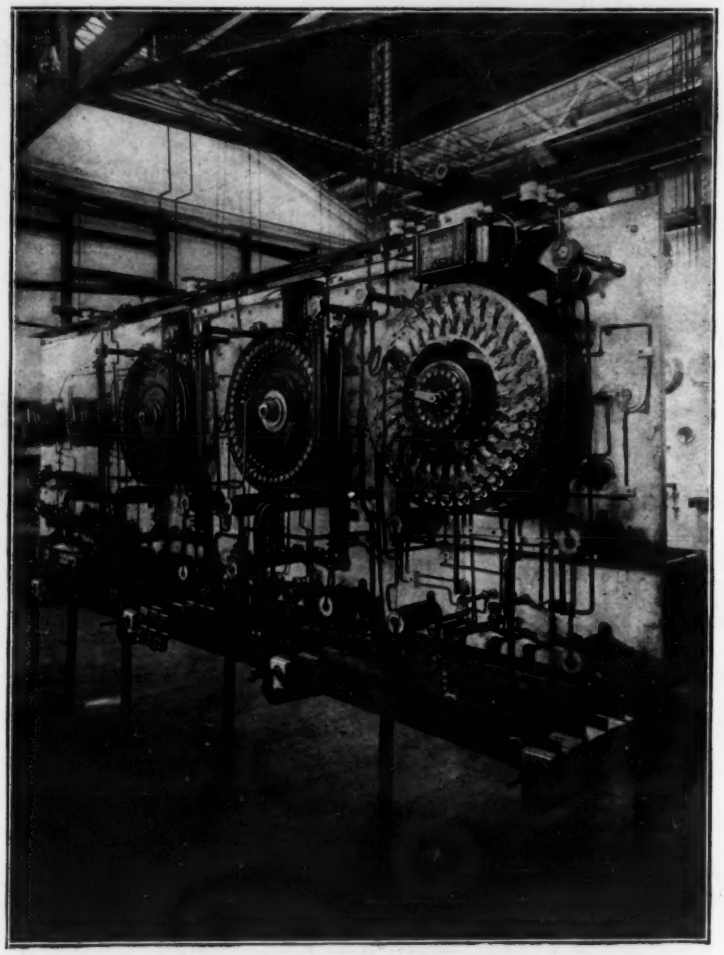


FIG. 3.—REAR OF SWITCHBOARD.

1 and shunt coil H to the ground. The current passing through H magnetizes the core S, which in turn attracts the armature P. This closes the switch and establishes connection between the 500-volt main feeder K, and button No. 2, through the contacts JJ, coil I and wiring N. The switch C is now closed, and switch A opened. The switch X_2 is kept closed, however, by the current flowing from the contact button No. 2 through bar Q_2, connection T, resistance L, connection R, bar Q_1, button No. 1, connection M and coil H to the ground. The car is now started, current from the main feeder passing through connection P to the controller and the motors.

When a short distance has been traversed by the car the contact bars make connection with a pair of plates connected to switch X_3. The current then passes from the contact bar Q_1 through the shunt coil of the switch. The operations above described are then repeated. As soon as the bar leaves the plates 1 and 2, current ceases to pass through the coils I and H of switch X_2, and this switch immediately opens by gravity, leaving the buttons connected to it dead and harmless. As connection has already been established through switch X_3, there is a continuous flow of current from the feeder, and no flash occurs either at the switch or the button. All the current passing to the car from the main through the switch contacts JJ passes through the series coil I, thus holding the switch firmly closed and preventing all possibility of its opening while current is passing through the contact, even if the circuit through coil H should be interrupted. The two switches A and C, shown on the diagram, are in practice combined in one circular switch of special make, and the necessary combinations for picking up the current are made by one revolution of the switch handle. The battery is charged by leaving switches A and C simultaneously closed. The storage battery need only be employed to lift the first switch, for after that one has closed, the contact bars bridge the main voltage over from one set of plates to the other, as already described, thus closing successive switches without further attention on the part of the motorman.

The electromagnetic switch is shown in Figs. 6 and 6a, the former being a general view and the latter a view of the lower side. Fig. 7 shows the switch and its parts assembled. It is secured to the interior of the cast-iron casing A, the switch and magnet being mounted on a marble slab attached to the casing by means of screws in the bosses BB. The iron pan C contains the cable terminals and supports the casing, the pan and casing together completely enclosing the switch. The switch magnet M is of the ironclad type, and is provided with a fine shunt winding for the "pick-up" current, and a coarse series winding through which the working current passes. When magnetized, the poles attract an armature attached to a bridge-piece J, each end of which carries a carbon disk N. Above these disks are stationary disks O, mounted upon a marble base. One of these is connected by the contact cup G_1 to the positive main cable, and the other is connected through the series coil and cup G_2 to the postive contact plate. The pan C is provided with four projections S, which support the vertical split pins F. These are insulated from the pan, and slide into contact cups G. The pins are provided with connectors I, for making contact with the several cables H. After the connections are made the pan is filled with paraffin to exclude moisture, and its outside channel D, which receives the casing, is filled with a heavy non-vaporizing oil. The casing can be lifted off to allow examination of the switch without disconnecting the wires. It is tested to an air

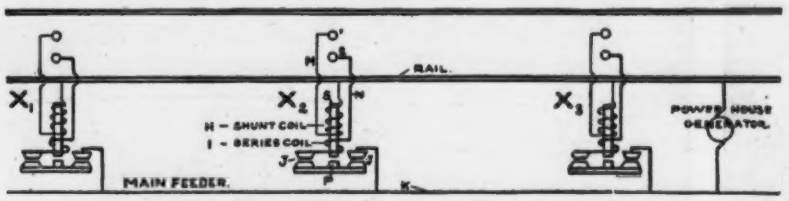


FIG. 4.—SWITCH CONNECTIONS, ELECTROMAGNETIC TRACTION SYSTEM.

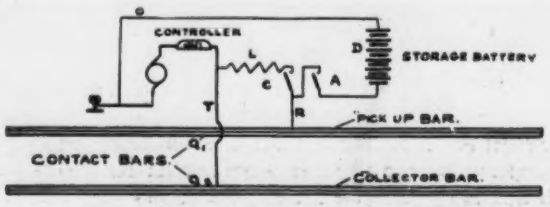


FIG. 5.—DIAGRAM OF CAR CONNECTIONS.

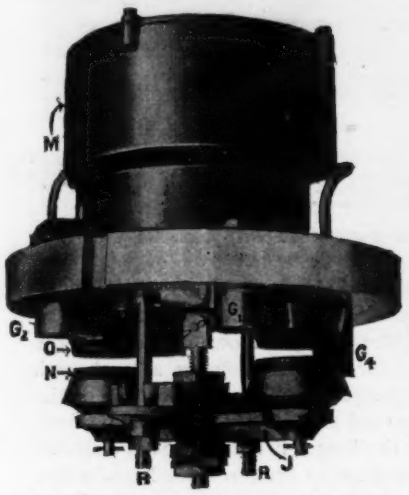


FIG. 6.—ELECTROMAGNETIC SWITCH.

FIG. 6A.—LOWER SIDE OF SWITCH.

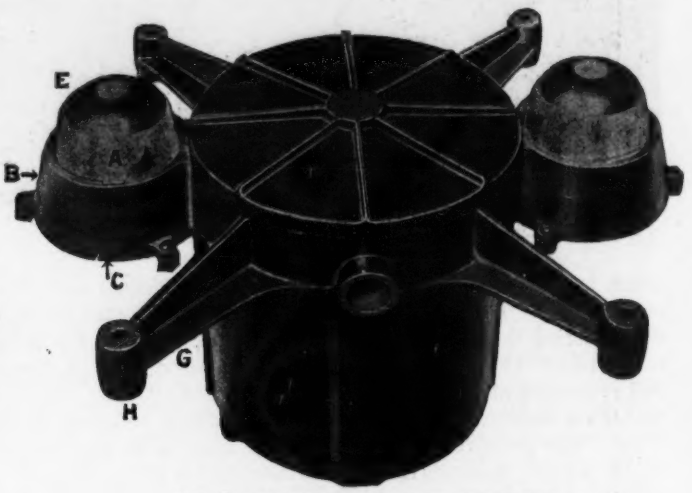


FIG. 8.—COMBINATION UNIT COMPLETE.

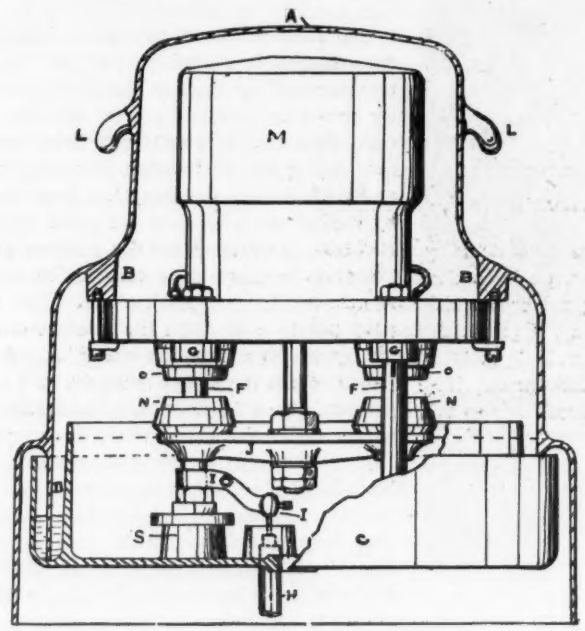


FIG. 7.—DIAGRAMMATIC SECTION OF SWITCH, BELL AND PAN.

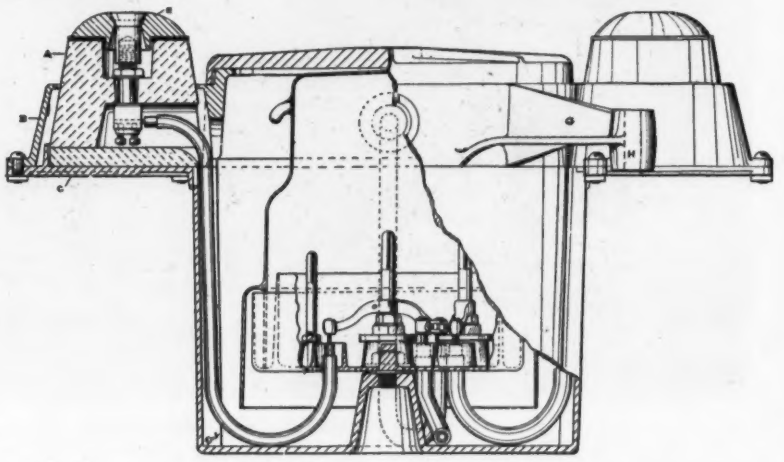


FIG. 9.—SECTION OF COMBINATION UNIT.

pressure of 25 lbs. per square inch, and it may be entirely submerged in several feet of water without affecting the operation of the system.

The combination unit of the switch with its pan and casing, shown in Figs. 8 and 9, is enclosed in a cast-iron switch box, and may be wired at the works and shipped ready for installation. The box has brackets supporting the two contact plates or buttons *E*, each of

FIG. 10.—VIEW OF TRACK AT INDIAN HEAD, BALTIMORE, MD.

which is fitted to a composition insulator *A*, cemented into the cup or bracket *B*. The radial arms on the box are supported by the ties, thus insuring the proper leveling of the contact apparatus in relation to the rails. The contact buttons are of cast-iron, 4½ ins. diameter, and projecting about ⅝-in. above the pavement. This is sufficient to enable the collector bars to make contact without touching the pavement. The positive main or feeder is encased in iron pipe, and passes directly through each switch box, and a tap is made to each switch. No additional wires are used to connect the coils or contacts of adjacent switches.

The trains run from the overhead wire to the surface contact system without trouble or interruption. The track is of standard gauge, laid with 56-lb. flanged rails, and operated by a current of 500 volts from the electric power house upon the grounds. Fig. 10 shows a view of the surface contact system at Indian Head, over which are operated two 100-hp Baldwin-Westinghouse freight locomotives, one of which is shown in Fig. 11, and a 70-hp combined passenger and freight car shown in Fig. 12. These are used for hauling freight from the dock on the Potomac River to the various departments, and also for conveying guns, armor plate, building and manufacturing material. These locomotives are provided with trolley poles, as well as with metal contact shoes, the former for the overhead system and the latter for the surface contact portion of the track. There are several 5 per cent grades and a number of short curves, but the locomotives haul from 30 to 40 tons, passing from the overhead trolley to the surface contact system, and vice versa, without stopping, as the two systems overlap each other for a short distance at each end. Lieutenant Strauss, U. S. A., inspector of ordnance, in charge of the proving grounds, reports that the road is successful in operation, and, in fact, becomes more successful the longer it is used. It is operated by the men stationed at the grounds, who are not skilled mechanics, the general supervision being in the hands of the electrical engineer of the central electrical power house.

FIG. 12.—70-HP. COMBINATION PASSENGER AND FREIGHT CAR.

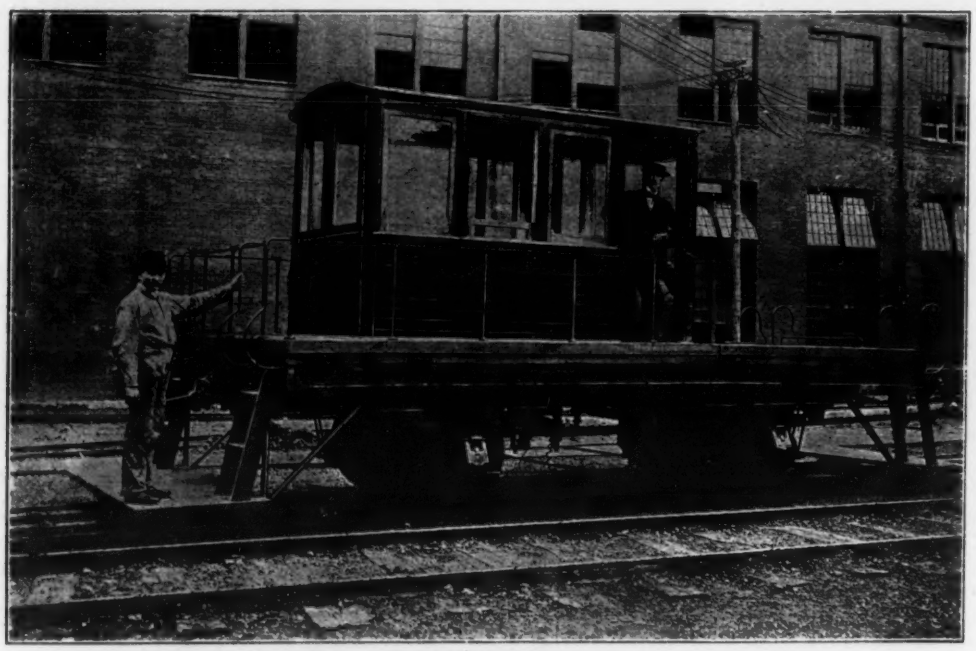


FIG. 11.—100-HP. MOTOR FREIGHT CAR.

Utilizing Russian River Power Electrically.

The Russian Finance Minister is at present engaged in studying plans for the employment of the falls in the River Dnieper for producing electric power, says the Chicago *News*. The plans have been worked out by a corps of Russian army engineers, and with these a company has been formed by capitalists, who have set apart 6,000,000 roubles ($3,000,000) for the purpose of developing the plans as soon as the concession is granted by the Government. The company proposes to make the Dnieper navigable from Ekaterinoslav to Alexandrovsk and transmit the power from the falls to the former city, where, of late, numerous factories, mills and mines have been opened. Some years ago an English company had been formed for the same purpose, but, owing to a severe press campaign against them, they were unable to obtain the concession. The Ekaterinoslav district is one chiefly of coal and ore mines, most of which are in the hands of the Belgians. It is stated that the Belgians have not less than from $360,500,000 to $412,000,000 interested in this one district. So important are the interests of Belgium in the district of Ekaterinoslav that not long ago the Belgian Consulate-General at Odessa was transferred there. In Southern Russia this entire district goes under the name of New Belgium.

Dielectric Strength.

BY JAS. ROWLAND BIBBINS, B.S.

ALTHOUGH the subject of Dielectric Strength has been treated at considerable length in the various scientific periodicals for some years past, a presentation of the subject in its more general aspect, together with comparative results of various experiments, has not, it is believed, been attempted. The following is intended as a brief exposition of results, especial attention being directed toward the establishment of a secondary standard for use in ordinary shop tests of materials and apparatus.

THE GENERATION OF HIGH POTENTIALS.

The generation of high potentials, involving the transformation of appreciable amounts of electrical energy, has, until recent years, been practically an impossibility on account of the comparative timidity with which high potentials have been exploited, and the lack of suitable insulating material which would stand up under severe electrostatic stress.

Before the advent of the transformer proper, static electricity was utilized entirely for accurate experimental work. To be sure, induction coils of sufficient power were then in existence, two notable examples being the Apps or Spottiswood coil in England, and the William Wallace coil in America, both of which are useless by reason of their punctured insulation. But the inherent defects of the mechanical break almost invariably used in large coils, render them entirely useless as a means of accurate experimental work.

As the principles of the transformer proper became well known, and their manufacture sufficiently improved to admit of the use of high potentials, experimenters gradually adopted the transformer for testing purposes, as any desired potential could be obtained by connecting a sufficient number of transformers in series. Following the use of this system, came that in which a single transformer was used to generate the whole potential at one step.*

The Thomson high-frequency transformer, by means of which Tesla has recently obtained two million volts with comparatively simple apparatus, is, unfortunately, unsuited for testing purposes, mainly on account of the heavy convective or leakage discharges which cannot be suppressed. This makes it impossible to construct an instrument which may be relied on to actually measure the potential.

HISTORICAL.

The first absolute measurements of the potential required to force a current through an intervening stratum of dielectric were made by Lord Kelvin in 1860, followed by more recent experiments by McFarlane, Liebig, Steinmetz, Edmonson and others. With the exception of Steinmetz, static electricity was used in all cases as a means of obtaining potential gradients of air, gases and solid dielectrics. The only direct-current measurements on record are those of De La Rue, with his famous aggregation of chloride of silver cells. A large proportion of earlier experiments were confined very strictly to air and gases, and, together with the more recent work on air, are only essential to this paper in so far as they furnish a standard of measurement for the determination of e. m. fs. under varying conditions of test. In the absence of absolute measuring apparatus, all observations must be referred to a standard, or to a subsidiary standard which has previously been calibrated. The observations of Kelvin, McFarlane and Liebig deal with static discharges in a uniform field, such as is obtained by the use of parallel disks or plates separated for a distance, which is small as compared with the diameter of the plates. Other observations have been made with a non-uniform field between balls, and cylinders of various sizes and combinations of either.

In 1888 McFarlane extended his observations on gases to solids and liquids, with results given in Mascart and Joubert, Vol. II., and in 1893 in connection with G. W. Pierce, contributed further results on wax, oils and paraffine. In 1887 Dr. Liebig contributed accurate absolute determinations on air and gases, *Phil. Mag.*, 5-10. In 1893 Steinmetz gave his first results of dielectric tests on liquid and solid dielectrics, and in 1898, a very comprehensive paper on the "Dielectric Strength of Air." Also in 1898 articles appeared by Edmonson on liquids, and by Gray on solid and liquid dielectrics in general. The more practical side of this subject has been taken up by graduate students at the laboratories of various technical schools.

In most of these tests parallel disks were used to enclose the dielectric which was submerged in oil, if found necessary, in order to confine the discharge to the material. In order to measure the potential a sort of overflow air-gap was placed in shunt with the discharging disks, and the gap being adjusted by a micrometer screw, was gradually lengthened until the discharge preferred to pass through the material under test. The measured length of the air-gap was then referred to an absolute potential gradient, by which means the disruptive e. m. f. of the material was obtained.

*Paine and Gough, *Electrical World*, 1898.

POTENTIAL GRADIENT.

The relation between thickness of dielectric and disruptive potential of most materials is by no means constant. For non-uniform fields with equal dimensioned spheres, the graphoo curve obtained by plotting these quantities as co-ordinates is approximately parabolical within a certain range. Various formulas, empirical and absolute, have been advanced by various experimenters, expressing the value of the potential gradient, $g = \frac{V}{\delta}$, where V is the desruptive potential and δ the measured thickness of the dielectric. No physical law, however, has been discovered which will cover all observations.

THEORY OF DISRUPTION.

When a dielectric is subjected to an electrostatic charge, either constant or variable, the energy of the charge manifests itself as a stress on the dielectric medium.

Assume, A = area discharge disks.
δ = sparking distance.
V = disruptive potential.
a, b, c, d, k = constants.
e = energy per unit volume required to break down the dielectric.

Then the total energy of the spark is

$$E = Ade = k \frac{A\ V^2}{8\ \pi\ \delta}$$

$$V^2 = \frac{8\ \pi\ e}{k}\ \delta^2 \text{ or } V = \sqrt{\frac{8\ \pi\ e}{k}}\ \delta$$

which is the formula for the absolute electrometer. This shows that if unaffected by other causes, the curve of disruptive discharge is a simple linear function, $V = k,\ \delta$. However, convection or leakage currents at all potentials, but mostly at higher ones are present, and a portion of the energy is used up in recharging the successive layers of molecules, which are constantly being projected across the intervening area between electrodes and being replaced by neutral molecules. This convective action may be taken account of by expressing the actual repulsive effect of the projected particles. This is proportional to the surface, or $R = Ar, r = \frac{R}{A}$ where R is total thrust. The complete energy equation is then $E = Ade + Ar$, and

$$V^2 = \frac{8\ \pi\ e}{k}\ \delta^2 + \frac{8\ \pi\ \delta}{k}\ r, \quad or \quad V = \sqrt{\frac{8\ \pi}{k}}\ \sqrt{e\ \delta^2 + r\ \delta}$$

which is of the form found by many experimenters

$$V = \sqrt{a\ \delta + b\ \delta^2}$$

Steinmetz found for some materials that a simple linear function $= a\ V$ applied, which would indicate that the gradient (g) is independent of the thickness. For other materials, the addition of a quadratic term gave fair agreement with his tests $\delta = a\ V + b\ V^2$. For a large range in air he found that the gradient was represented quite accurately by $\delta = a\ V + b\ V^2 - c$, in which case the parabola did not start at the origin, but about 650 volts above it. For lower values, the curve left the parabola and sloped toward the origin. This necessitated the addition of a third term, exponential, and his final formula.

$$\delta = c\ (e^{-dv} - 1) + a\ V + b\ V^2$$

then represented the results of his tests throughout their entire range. Introducing constants for air,

$$\delta = 36\ (e^{-1.3V} - 1) + 54\ V + 1.2\ V^2$$

These results he obtained by the use of transformers in series and parallel plates.

In 1882, Baille published an account of his experiments on air and gave for distances less than 1cm. with parallel plates

$$V^2 = 10500\ (\delta^2 + .08\ \delta)\ \text{(C.G.S.)}$$

an hyperbola.

Similar expression has been deduced by McFarlane for the same distances,

$$V = 66940\ \sqrt{\delta^2 + 0.20503\ \delta}\quad \text{C.G.S.}$$

which differs by about 10 per cent from Baille's results. The latter appear to be the most reliable absolute measurements. The results

of Chrystal and Liebig may be embodied in the linear function $V = 4.99 + 99.59\,\delta$ for sparks greater than 2mm. This is shown from the curve (Fig. 2, curve 1).

We have then, for air:

1. Chrystal, Liebig, Carey Foster — $V = a + b\,\delta$
2. Baille, McFarlane — $V = \sqrt{a\,\delta + b\,\delta^2}$
3. Steinmetz, Pierce — $\delta = a\,V + b\,V^2$
4. Steinmetz — $\delta = c\,(e^{-dV} - 1) + a\,V + b\,V^2$

Curves 1 and 2 of Fig. 1 show the application of the quadratic (3). A considerable variation is apparent between Steinmetz's results and

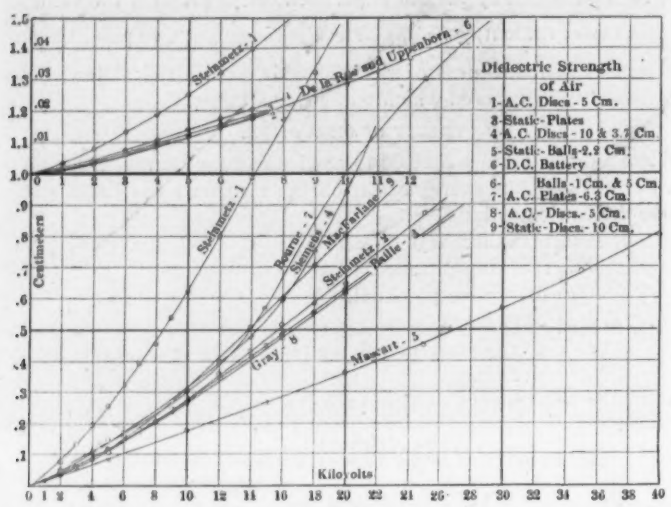


FIG. 1.

those of the other experimenters. Pierce states that by multiplying Steinmetz's value for δ by 0.442 and dropping the exponential term, which vanishes for all but very small values of δ, the equation thus obtained, $\delta = 24.27\,V + 0.53\,V^2$, represents his observations accurately and agree fairly well with those of others. We may then draw the following general conclusions for a uniform field in air:

(1) That for very small values of δ the electrostatic gradient may be represented by a quadratic function, $\delta = a\,V + b\,V^2$.

(2) That for the high values of δ or V the gradient is represented by a simple linear function, $\delta = a + b\,V$.

(3) That for solids and liquids the gradient is represented by a linear function,

$$\delta = a + b\ V \left(a \gtreqless o\right)$$

All of the above formulas, with the exception of Steinmetz's, were deduced for discharges of comparatively small length and invariably for a uniform field. This is accomplished by means of parallel plates carefully ground and separated by only a small percentage of their diameter, about 10-12 per cent.

If the plates are separated to a considerable distance the field is largely disturbed by the rounded peripheres, and instead of being uniform, approaches that of equal spheres. The breaking down of a dielectric is strictly analogous to the failure of a loaded beam. As soon as the limit of tensile strength is reached the fibres give way and the beam breaks down. When a "test piece" is prepared for the testing machine, a uniform section is maintained throughout its length, and the stress gradually increased to the yielding point.

In order to apply an analogous method to air for high values of δ = 6-12 ins., it is obviously necessary to employ plates 6 or 8 ft. in diameter in order to preserve a uniform field, and this arrangement would introduce so much capacity as to vitiate results. Steinmetz investigated the case of cylinders with the ends bent back as giving the nearest approach to a uniform field, but the gradient differed very materially from that of parallel plates.

We are then forced to rely upon results from points and spheres for high ranges of potential, and points are preferable, being more convenient and giving the conditions of maximum electrostatic stress on the material under test.

The before-mentioned variations in Steinmetz's results have been explained by Pierce. The former in his tests with air and liquids separated his electrodes by pieces of glass or mica of measured thickness, these being perforated to allow the spark to pass through the material under test. Experiment has proven that the introduction of a foreign substance into a uniform field, thus breaking its continuity, considerably weakens it.

In comparing the gradients for air, and for air over a separating stratum of glass, Pierce found that δ (air) = 0.442 δ (glass).

The coefficient 0.442 introduced into Steinmetz's formula brings his observations into close agreement with those of other experimenters, as shown in Fig. 1, curve 2. McFarlane also questions the uniformity of the field used by Steinmetz, as the discs were only 2 ins. diameter and separated 2-cm. in air and 9-cm. in oil. Steinmetz's curve for points (Fig. 3, curve 1) has a very interesting shape. Up to 1¼ in. $\delta = .05\,V$. The curve then bends upward and follows $\delta = .125\,V - 2.75$, or $V = 8\,\delta + 22$. If this line is extended backward, it passes through the X axis at about 22,000 volts. If we assume this amount lost by convective discharge, the line may be displaced parallel to itself, and passes through the origin, thus indicating that the remaining voltage is proportional to the striking distance. This so-called "critical point," at which convective discharges begin to take place, has recently been noted by Charles F. Scott in his high-voltage transmission work (Trans. A. I. E. E., Vol. 15, No. 10), and curves 2, 3, 4, 5 show it to be less sharply defined as the radius of curvature of the electrodes is decreased. Plate 3 shows this in a striking manner. The greater the diameter of spheres, the more remotely from the origin does the curve leave the line $\left\{\begin{matrix} y = x\ tan\ \Theta \\ \delta = .186\ V \end{matrix}\right.$ and the less clearly defined the critical point.

A curious point is brought out in Edmonson's curves for spheres and very small voltages (Fig. 4). Here the order of curvature is reversed. The curves then cross at a point (.3,38) and continue in straight lines, which, if sufficiently extended would probably find their completion in the upper portions of Steinmetz's curves. Another curious phenomenon appears upon the introduction of a 10-in. metallic disk into the active electrostatic field. The disruptive voltage necessary to force a spark across the gap is much greater than without the disk, although the net air space is reduced. The explanation lies in the supposed existence of a counter e. m. f. of the spark. The introduction of the plate increases the number of transitions from metal to air and vice versa, and thus the c. e. m. f. opposing the applied e. m. f., if we assume a c. e. m. f. to be generated at each junction between air and metal.

METHODS OF TESTING.

If the experimenter is fortunate enough to possess an accurately calibrated absolute electrometer, or electrostatic voltmeter of suffi-

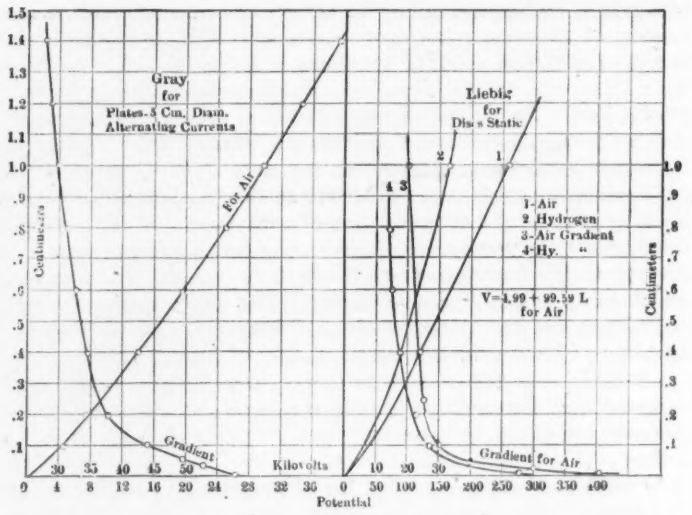


FIG. 2.

cient range, the potential at the electrodes is determined directly by simply charging the plates of the instrument with the spark-gap potential. This method applies to all forms of currents of any potential or frequency within the limits imposed by convective discharges. Usually the lower plate is grounded and the upper plate and one electrode of the spark micrometer connected to the source of potential. In working with static discharges, it is quite necessary to introduce a Leyden jar between the machine and electrometer, as it serves to prevent abnormal rise of potential.

In the case of oil, the direct electrometer method is unsatisfactory for the reason that a number of sparks must be passed through the

liquid before a satisfactory balance can be obtained. This produces a fine deposit of carbon on the electrodes and forms a chain of fine particles in the oil which materially reduces the apparent disruptive voltage. For ordinary experiments the indirect method is very applicable. Two micrometer or adjustable spark-gaps are placed in parallel, and the air-gap is gradually lengthened until the spark prefers to pass through the dielectric in the other; the gradient for spheres or points is then made use of as a subsidiary electrometer.

The use of high potential alternating currents for testing purposes

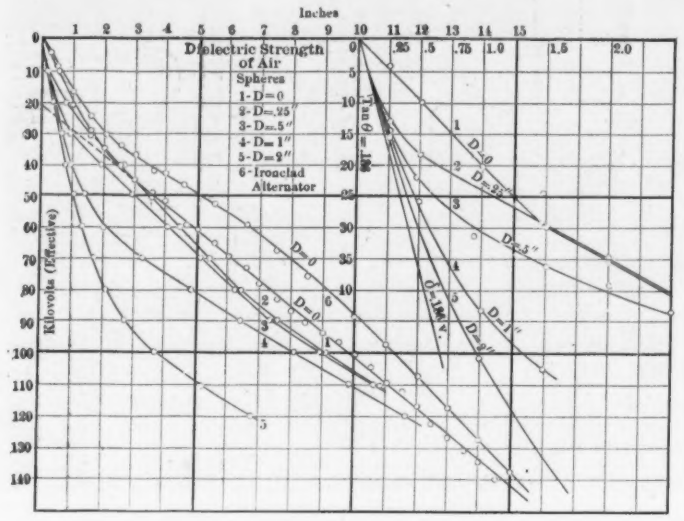


FIG. 3.

offers many advantages. (1) It is possible to realize a real power discharge, or one conveying considerable current. (2) Transformers are much less bulky than static machines, and their operation is independent of atmospheric conditions. (3) The secondary voltage may be determined, under certain conditions, by multiplying the primary voltage by the ratio of transformation. It may, however, be determined by either an absolute electrometer or a calibrated Kelvin multicellular voltmeter of sufficient range If the latter is of the ordinary "White" type, even though supplied with a bifilar suspension and weights, this instrument is necessarily limited to about 15,000 volts on account of sparking between plates. In the alternating-current method errors may creep into the results from several causes. (1) Shape of wave. If

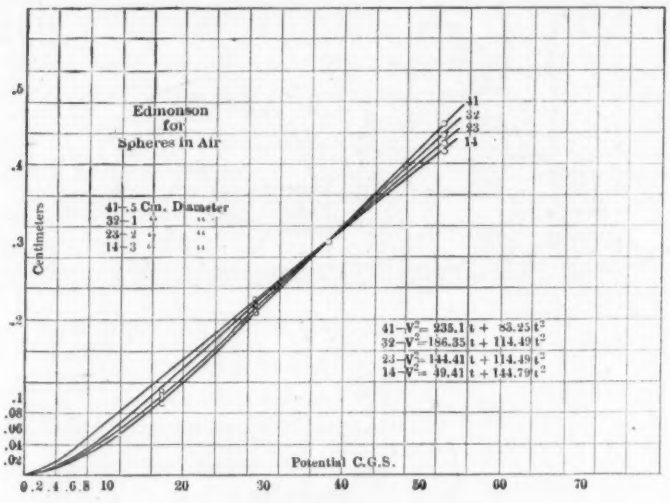


FIG. 4.

this differs from a sine wave, the maximum e. m. f. cannot be obtained from the $\sqrt{\text{mean}^2}$ or integrated reading of alternating-current instruments by multiplying by $\sqrt{2}$ In this case, the percentage error must be determined and a correction introduced therefor. The wave form of a smooth core alternator seldom differs much from a true sinusoid, and then the maximum secondary potential is the same as would produce a static disruptive discharge of the same length through the material in question. But ironclad or toothed armatures often give a greatly distorted wave form which is also quite unstable, and therefore unsuited for accurate determinations. (2) Reactance in the generator circuit has a marked effect upon the wave form of an ironclad machine, but comparatively small effect upon that of a smooth core machine. Either a peaked or very flat wave should therefore be avoided, and a saw-tooth wave is entirely unsuited, as the $\sqrt{\text{mean}^2}$ value varies so considerably with external conditions. (3) If the magnetic induction in the transformer is carried too near saturation, it is well known that leakage will increase considerably, resulting in an increase of the ratio of transformation. In a testing transformer, however, full load is never realized, since the fuse in the primary circuit blows as soon as the discharge passes, thus limiting the primary current to that required or magnetization only.

Hence the induction may be placed at quite a high value without great danger of leakage. (4) The value of ratio transformation when several transformers are used in series. This may be determined by placing the secondaries in parallel and primaries in series

DIELECTRIC STRENGTH OF AIR.

Kilovolts.	Steinmetz—1893 Discs—5 cm. f = 150.	Steinmetz × .442 (Pierce).	Siemens—1892 Discs—10 & 3.7 cm. f = 100.	Bourne—1892 Plates—6.3 cm. A. C.	Uppenborn—1893 Balls—1 & 5 cm.	De La Rue Early Discs—D. C.	Mascart—1876 Balls—2.2 cm. Static.	Macfarlane—1880 Discs—10 cm. Static	Baille—1882 Plates—Static	Thomson—Discs.	Gray—1898 Discs—5 cm. f = 133	Steinmetz—1898 Points—f = 125.
	Cm.	Cm.	Cm.	Cm.	Cm.	Cm.	Cm.	Cm.	Cm.	Cm.	Cm.	Cm.
1	0.030	0.013	0.024	....	0.013	0.021	....	....	0.013	0.013	0.015	....
2	.077	.031	.048	....	.030	.043	....	....	.035	.042	.040	....
3	.132	.058	.073	....	.052	.066	....	....	.060	0.62	.065	....
4	.192	.085	.105	....	.078	.091	....	0.012	.070	.100	.090	....
5	.255	.113	.139	0.150	.105	.118	0.090	.135	.120	.127	.120	2.40
6	.323	.143	.171	....	.133	.147	....	.160	.150	....	.150	....
7	.396	.174	.206	....	.162	.180	....	.172	.177	....	.180	....
8	.418	.207	.240	....	.190	.215	....	.213	.210	....	.210	....
9	.540	.239	.277	....	.220	.250	....	.260	.245	....	.246	....
10	.622	.275	.317	.300	.254	.286	.180	.300	.280	....	.277	1.27
12	.800	.354	.400	....	.320	.365	....	.405	.350	....	.342	....
14	.988	.437	.480	....	.388	....	....	.505	.420	....	.408	....
15	....	....	....	.570	....	....	.270	....	.450	....	....	1 77
16	1.173	.518	.598	....	.460	....	....	.605	.485	....	.477	....
18	1.320	.583	.755	....	.538	....	....	.705	.555	....	.548	....
20	1.476	.649	.940	1.000	.623	....	.360	.800	.630	....	.619	.256
25	2.200	.973	....	1.300	.940	....	.450	....	.780	....	.809	....
30	....	....	....	1.610	....	....	.570	....	.950	....	1.080	....
35	....	....	....	1.930	....	....	.690	....	....	....	1.220	....
40	....	....	....	2.240	....	....	.800	....	....	....	1.436	6.69
45	....	....	....	2.600	....	....	.900	....	....	....	....	....
50	....	....	....	3.100	....	....	1.100	....	....	....	....	.070
60	....	....	....	4.100	....	....	1.700	....	....	....	....	11.23
70	....	....	....	5.100	....	....	2.340	....	....	....	....	17.04
80	....	....	....	6.350	....	....	3.300	....	....	....	....	18.44
90	....	....	....	7.600	....	....	4.370	....	....	....	....	21.23
100	....	....	....	9.330	....	....	5.800	....	....	....	....	24.99
110	....	....	....	11.100	....	....	7.500	....	....	....	....	27.50
120	....	....	....	....	....	....	10.350	....	....	....	....	31.24
130	....	....	....	....	....	....	12.600	....	....	....	....	34.29
140	....	....	....	....	....	....	....	....	....	....	....	36.83
150	....	....	....	....	....	....	....	....	....	....	....	38.10
160	....	....	....	....	....	....	....	....	....	....	....	40.00
Equation.	$\delta = 36\,(e^{-1.V} - 1) + 54\,V + 1.2\,V^2$	$\delta = 24.26\,V + .53\,V^2$	$\delta = 26\,V + .55\,V^2$ $V = 14$ 5	$\delta = 30\,V + .62\,V^2$	$\delta = 10\,V + .6\,V^2$ $V = 20$ 8	$\delta = 18.84\,V + .98\,V^2$	$\delta = -10.7\,V + .65\,V^2$ $V = 90$ 50	$V = 20030\sqrt{\delta^2 + .235\,\delta}$. $\delta = 1.0$ $.100$	$V = 102.4\sqrt{\delta^2 + .98\,\delta}$	$\delta = 15\,V + 2.3\,V^2$.	$\delta = .318\,V$ for High Values	

with generator, and measuring the terminal voltage of each primary. If these readings disagree, a correction must be used.

(5) Capacity in high potential circuits, if considerable, decreases the ratio of transformation by a small percentage, but the capacity of coils and discharge plates is entirely negligible.

(6) Calibration of instruments should be made frequently in order to insure against alterations in adjustments.

(7) Discharge terminals should either be cleaned, amalgamated or replaced after each test. Needles may be replaced, balls and plates amalgamated and repolished.

(8) Effect of increased frequency on discharges is simply to increase the convection currents indicated in air by a partial breaking down of the air stratum previous to the final failure. Within the limits of ordinary commercial frequencies, 60-125, the effect of a change is not apparent. For high frequency currents, however, the effect is striking. The ratio of transformation is decreased to a remarkable extent,

the convective discharges are enormous and the striking distance largely increased.

(9) The corona, or luminous effect, which is observed when testing mica, should not be mistaken for disruptive discharge. It is apparently a condenser effect, inasmuch as the length of spark which discharges over the surface is many times greater than is accountable for by the voltage.

(10) An ironclad alternator often gives high-frequency discharges in the secondary circuit. If the high-voltage readings are very erratic and convective discharges are heavy, a Tesla transformer placed in circuit is likely to give a high-frequency spark of considerable length. This effect is clearly brought out in "A Photographic Study" of a Power Discharge. (Steinmetz, *Elec. World*, 23-10.) With an exposure of one-tenth to one-half second a great number of clearly-defined striations appear interspersed with the more intense portions of the arc. The shortness of exposure precludes any idea of their being formed by currents of ordinary frequency.

Two Electrically Driven Pumps at the Paris Exposition.

In the German section of the mining exhibit, on the Champ de Mars, are shown two pumps, driven directly by three-phase electric motors. One of these is a Riedler express pump, driven by a 75-hp Allgemeine Elektrizitaets Gesellschaft three-phase motor, and the other is a high-speed triple-plunger pump, built by Ehrhard & Sehmer, of Schleifmuehle, near Saarbrucken, and driven by a 100-hp

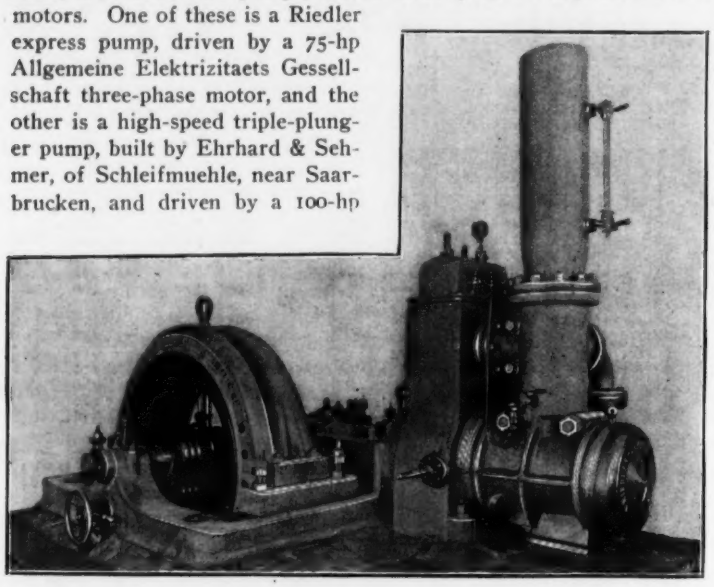
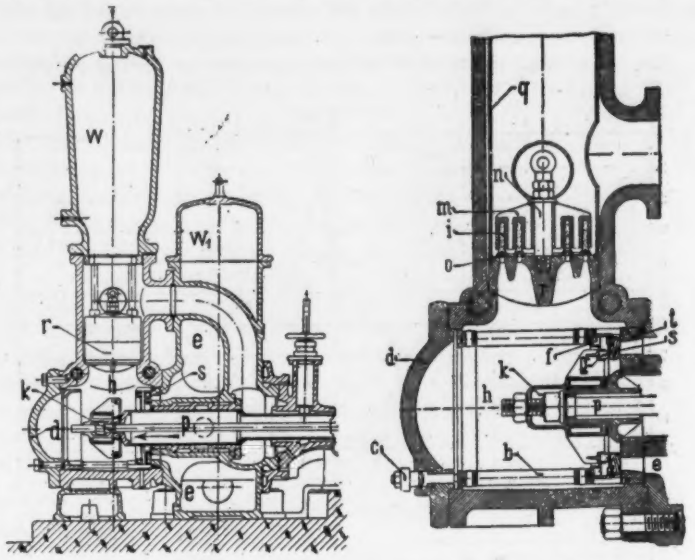


FIG. I.—RIEDLER PUMP.

three-phase motor from Lahmeyer Company, of Frankfort-on-the-Main. The first of these two pumps runs at a speed of 300 r. p. m., and will elevate 1100 litres per minute 270 metres high at an efficiency, it is claimed, of 87 per cent. The other pump runs at a speed of 200-250 revolutions, and will raise 1100-1250 litres per minute to a height of 250-300 metres. The efficiency claimed is 92 per cent.

Pumps were originally slow-speed machines, making at most 25-30 r. p. m., either driven directly by equally slow-speed steam engines, or else through the intermediary of some speed-reducing mechanism, such as gears, belts, etc. The advances in steam engine construction gave occasion to build pumps of from 60-100 r. p. m., but these were about the highest speeds reached. There was still a very large difference between the speed of the ordinary electric motor and the speed of the common pump, so that the only way of driving a pump electrically seemed to be through the intermediary of some sort of reduction gearing. It has been the aim of electrical engineers, from the beginning, to do away with mechanical transmission devices and to apply the motor directly wherever possible. Accordingly a number of rotary pumps have been designed which will run at high speeds and are therefore well suited for direct connection to electric motors. It was soon discovered, however, that the rotary pump cannot be adapted to elevating the fluid to any great height, which proved a serious defect in some operations. This difficulty was overcome by constructing multiple pumps, of which the single ones are connected in series, but the large number of working parts, and the rather large floor space required by these machines, are elements which count against them. It is thought, therefore, that the solution of the problem of electrically driven pumps lies in the perfecting of the ordinary pump so as to adapt it to a comparatively high speed and to connect it directly to a low-speed motor, and it is along these lines that Prof. Riedler, the inventor of the pump illustrated in Fig. 1, has directed his efforts.

Fig. 2 shows a cross sectional view of the pump, and Fig. 3 another view showing the valves more in detail. As will be seen from the figures, the Riedler is a plunger pump, the plunger being indicated by *p*.



FIGS. 2 AND 3.—CROSS SECTION AND DETAILS OF VALVE, RIEDLER PUMP.

When the plunger moves in the direction opposite to that illustrated by the arrow, water is drawn from the suction chamber *e* through the valve *s* into the pump chamber *h*. On the return stroke of the plunger the water is forced from the pump chamber *h* through the valve *r* into the air chamber *W*, which connects directly with the pipe leading from the pump.

Careful construction and simplification of all parts of the pump, together with the special form of valves, and the introduction of an additional air chamber, W^1, in the suction chamber, permits the unusually high speed of 300 r. p. m.

The suction valve *s* surrounds the plunger *p*, and consists of a ring of metal, or of a ring of wood with a metal frame. The seat *t* of the valve is held in place by a piece provided with rods *b*, which also act as guides for the valve and support its weight. This guide and support are held in place by bolts *c* passing through the cover *d*.

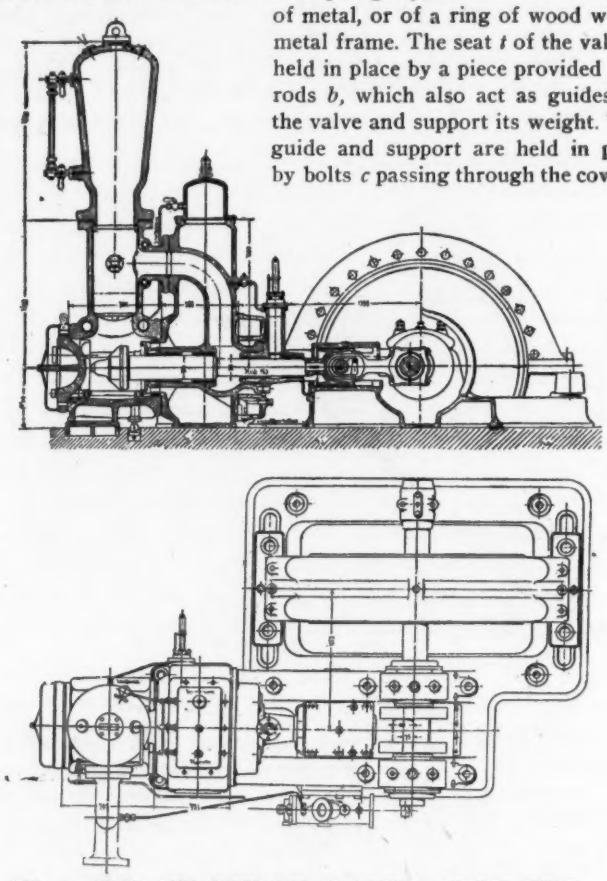


FIG. 4.—PLAN AND SECTIONAL ELEVATION, RIEDLER PUMP.

The valve guide also acts as a stop for the valve motion, and is provided with a rubber stop-ring to effect a smooth and noiseless opera-

tion of the valve. As the valve is not held down on its seat by springs, and as the slight weight of the valve is entirely supported by the guide rods, it offers almost no resistance to the passage of the water. It remains open until the end of the suction stroke, and is then closed mechanically by the plunger head *h* exactly at the dead centre. The plunger head is also provided with a rubber disk to insure smooth operation. Fig. 3 shows the plunger in the position

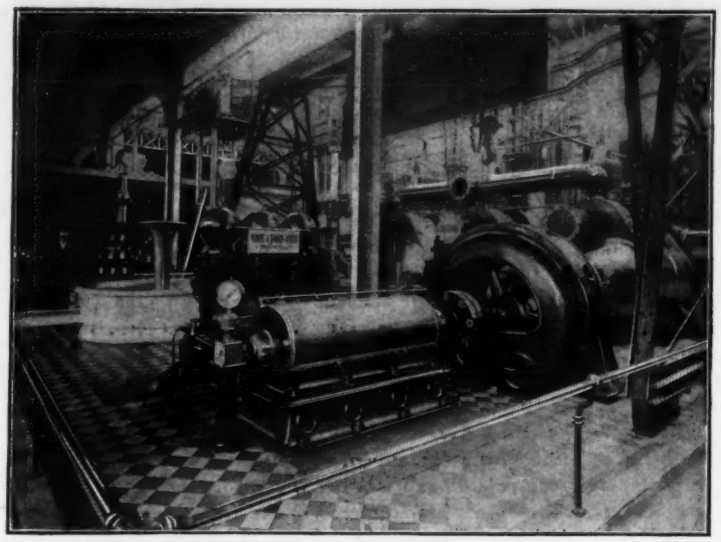


FIG. 5.—EHRHARD AND SEHMER PUMP AND LAHMEYER MOTOR.

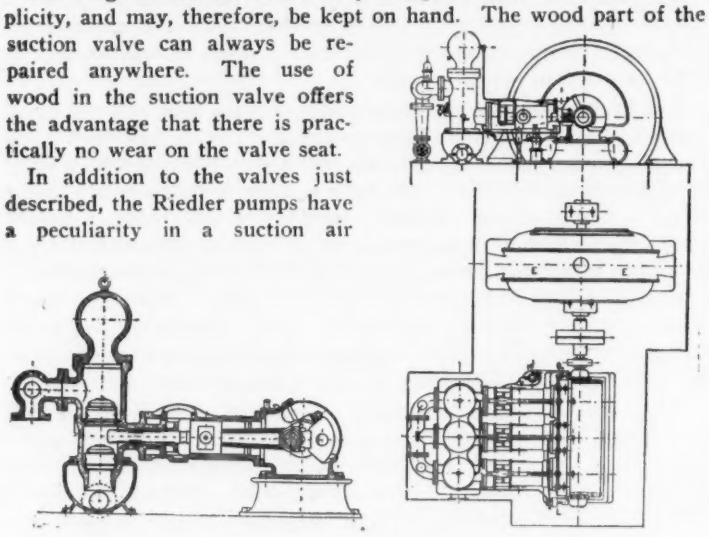
where the valve closes, while Fig. 2 shows the position of the valves during the force stroke.

The suction valve is easily interchanged. After removing the cover *d* on the end of the pump, the valve guide and support can be taken out, and after unscrewing the head *k* of the plunger the valve is free and may be removed from the pump chamber. The parts are, of course, just as easily replaced.

The valve *r*, through which the water is forced from the pump chamber to the air chamber, consists of rings *o*, resting on the seat plate *r*. They are held down on the seats by means of rubber springs *i*, which are guided by casting *m* and bolt *n*. The screws, by means of which the air chamber is fastened down, also hold the valve in place through the intermediary of a piece *q*. After removing the air chamber, the valve *r* may be taken out of the pump.

The rings of the valves are very cheap, on account of their simplicity, and may, therefore, be kept on hand. The wood part of the suction valve can always be repaired anywhere. The use of wood in the suction valve offers the advantage that there is practically no wear on the valve seat.

In addition to the valves just described, the Riedler pumps have a peculiarity in a suction air



FIGS. 6 AND 7.—CROSS-SECTION, PLAN AND ELEVATION, EHRHARD AND SEHMER PUMP.

chamber, in which the water level is always kept above the height of the suction valve. By this means a certain amount of water is always kept near the valve, and an interruption of the water column drawn towards the pump chamber is impossible, even at a very high speed, as the water in the air chamber always follows up with a certain pressure.

The Allgemeine Elektrizitaets Gesellschaft acquired the patents of this pump, and the first machines were set to work early in 1899. A list of installations given out by the firm contains 34 pumps either in operation or in course of erection, and of these 23 are driven electrically, while the rest are directly connected to steam or gas engines.

The pump exhibited by Ehrhard & Sehmer, Figs. 5, 6 and 7, is a triple plunger pump. The motor, *c*, is connected to the pump shaft by a shaft coupling. The triple crank has four bearings, which are all cast together with the crank casing, and it is therefore impossible for them to get out of line. The crank case has a sheet-iron cover, which can easily be removed when it is desired to inspect the crank bearings, etc. The lubricating oil gathers at the bottom of the crank case. Just outside of the crank case there is an oil pump, *o*, by means of which the oil is pumped from the case through a system of lubricating pipes to all the bearings and joints requiring oil. By means of a "Mollerup" force feed lubricator, *m*, oil is forced into the space behind the plunger packing boxes, and thus an efficient lubrication of these parts is insured.

The suction chamber is here located below, in what might be called the foot of the pump, the pump chamber in the centre and the air chamber, as usual, on top. The two valves are placed one above the other on the same centre line.

In the design of this pump the aim has been to keep down the velocity of the water, as a too high velocity simply reduces the efficiency of the pump by increasing the losses due to friction, and besides has a deleterious effect on the life of the valves.

Electrically-driven pumps are of specific advantage in such cases where the available floor space is restricted, or when the pump has to be located in places where no steam piping can be laid, or far away from steam boilers. The main application so far has been in mines.

PARIS EXPOSITION NOTES.

MR. W. G. MCMILLAN, secretary of the Institution of Electrical Engineers, has been a visitor at the ELECTRICAL WORLD AND ENGINEER headquarters.

MR. JAMES T. MARSHALL, of London, has been at the Exposition to look over the principal mechanical and electrical exhibits. Some of the pioneer work in connection with street railway power stations in England has been done by this engineer, who designed the generators for the Leeds tramways, and has been connected with work of a similar character in London.

MR. H. THOMSON LYON, of the British Institution of Electrical Engineers, is in Paris to look after the interests of that body, in connection with the visit of the engineers for the congress in August, and is a caller at the headquarters of the ELECTRICAL WORLD AND ENGINEER, which adjoins the space placed at the disposal of the American Institute of Electrical Engineers by Director Drake, of the Department of Machinery and Electricity.

MR. A. N. CONNETT, long connected with the French Thomson-Houston Company, as engineer in chargs of its railroad work, and well known through his contributions to the technical press, has now resigned from the above company to take charge, as chief engineer, of the London branch of J. G. White & Co., Incorporated, of New York. This company, as noted recently in the ELECTRICAL WORLD AND ENGINEER, is doing a large and increasing business in London, which is the centre of a large prospective development in electric traction, not only in Great Britain, now rapidly coming to the front in the adoption of street electric railways, but also abroad and in the colonies.

THE CLEVELAND TWIST DRILL COMPANY, Cleveland, Ohio, has a very elaborate and artistic exhibit, encased in one of the finest hardwood cases in the Exposition, ornamented with hand carving, the pilasters being of different patterns on each side, with a finish in old ivory and gold. The arrangement of the drills and tools is original and attractive. On one side they are so placed as to represent the United States, two flags being outlined in drills, and the opposite shows the insignia of the French Legion of Honor in drills and reamers. At one end of the case are the three trade marks of the firm, and at the other end the French motto, "Liberté, Egalité, Fraternité." All these devices are set out with regular finely finished tools. The base of the showcase is filled with many different tools, both large and small, such as grip sockets, oil tube sockets and oil tube drills. This is a new feature in this part of the world, which has long been used to old style methods, and the tools exhibited draw much attention and excite general interest.

Sixth Annual Meeting Ohio Electric Light Association.

THE sixth annual meeting of the Ohio Electric Light Association was held at Toledo, Ohio, on Aug. 14, 15 and 16, 1900, in Room 125 of the Boody House. The attendance was up to the usual standard. New members admitted were: W. P. Engel, of the People's Gas & Electric Company, Defiance, Ohio, and F. E. Valentine, of the Urbana Electric Company, Urbana, Ohio.

Pending arrival of some delayed delegates the reports of committees, etc., assigned for the first morning were passed and the president, D. L. Gaskill, of Greenville, Ohio, delivered his address, in which he briefly reviewed some of the important work of the committees for the year, and adverted to the question of municipal ownership and recommended the more general education of the people as to the false prophets who promise everything and execute nothing in the way of improvement of service. The address of the president was listened to carefully and elicited a hearty vote of thanks, moved by Mr. E. G. Schmidt, of Sandusky.

The afternoon was divided between pleasure and business, the Association assembling immediately after dinner to hear an address of welcome by Hon. S. M. Jones, mayor of Toledo, whose views on municipal ownership and kindred subjects are well known to our readers. Mayor Jones frankly told the Ohio Electric Light Association that he believed in municipal ownership, but he would not, if he could, enforce it *vi et armis;* but rather would abide God's leisure, and that all would come out right in the end. Mayor Jones gave a very warm welcome to Toledo hearts and homes. President Gaskill good-humoredly replied that it would be a strange world where nobody differed, and if there were no differences, little would be accomplished by people coming together. After the address by the mayor an adjournment was taken until 8:30 p. m., the delegates and their ladies in the meantime being given a boat ride on the historic Maumee, disembarking at Gard Island, where after a short stay they returned to the city and were much refreshed by the sail. The two launches were the Novia and the Psyche, the latter being the property of the Toledo Traction Company, and the former being a very fast steam launch which has the reputation of being the fastest boat on American fresh water. At first the ladies, some of them, were a little frightened when their craft tore through the water at the rate of 25 miles an hour, but they soon adjusted themselves to the situation, and thoroughly enjoyed the strange sensation. Returning to the hotel, the party took a trolley ride of an hour to cool off, and the gentlemen again assembled at 8:30 p. m. to resume deliberations. Papers were read by Mr. A. J. Stahl, of La Porte, Ind., and E. J. King, of the Fort Wayne Electrical Works. The subject of Mr. Stahl's paper was "Two Revenues Instead of One—Electricity a Bi-product." He briefly reviewed the advantages to be derived by combining a heating plant and electrical plant. The paper provoked an animated discussion, which took the form of inquiry after information, and Mr. H. T. Yaryan, of the Toledo Heating & Lighting Company, was called on to elucidate some of the points developed. Mr. Yaryan stated that in his opinion no corrosion whatever takes place in water that is used free from gases and air, and that water circulated for an entire season in this way through his heating system could be cooled off and drunk with comfort and safety, if desired. Experience had demonstrated that consumers would not give up the hot-water heating after once using it at any reasonable charge placed on its use. He contended that steam never had been and never would be a success for residence heating, and that no difficulty was experienced with his system of house heating in the coldest weather.

The subject of Mr. King's paper was "Induction Integrating Wattmeters." He outlined the conditions that should receive attention in the selectionof such matters, calling attention to the errors that exist in different meters on the market at this time. He referred to the voltage regulation for low loads and the flexibility of the induction wattmeter for circuits of different frequencies; also advantages in handling and installing. Messrs. Handley and Engel had some conundrums for Mr. King to crack, and after some discussion on these questions, the Association took an adjournment until Wednesday morning, when a paper was read by Mr. J. S. Peck, of the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. This treated of the principles which underlie the action of a transformer, and of those characteristics which are most desirable to the central-station man. He gave examples illustrating the saving which can be made by the use of transformers having low iron loss; and called attention to the fact which has heretofore received little consideration, that a transformer having a poor regulation but low iron loss may be more expensive to the central station than a transformer having better regulation and higher iron loss, not only on account of the poor service rendered, but also due to the fact that the meter reading is reduced at full load by the lower voltage impressed upon the secondary terminals. The paper was followed by lantern slides exhibited by Mr. Peck, the views being of different classes of electrical machinery, but largely showing the construction of various transformers; and in connection some beautiful views of Niagara Falls and the adjacent power plants, which Mr. Peck referred to as attracting attention from the entire engineering world. Mr. Peck's assistant in manipulating the lantern was Mr. S. T. Klotz, of the Toledo P. O. Dept., to whom a vote of thanks for his courtesy was awarded, upon motion of Mr. Thomas H. McLean, president and general manager of the Toledo Consolidated Electric Company.

The next paper was read by Mr. J. H. Perkins, of Youngstown, Ohio, on "Station Management," but which had as a fuller title, "The Operation of a Combined Lighting and Power Plant." He treated of the results in the operation of a combined lighting and power plant from alternating currents, all machines being of the same type, and run in parallel. He took up the results of incandescent lighting, arc lighting, motor work and street railway service from the view-point of a plant of this size (Youngstown). From the results there obtained he finds that except for very heavy overloads they are most satisfactory. The solution of the seeming difficulties in regulation he believed to lie in the adjustment of the rotary fields on the street railway, over-compounding at the higher loads, and keeping down the voltage at low loads. He referred to the difficulties in the operation of engines under these conditions and suggested remedies. The result of the experience was that with a properly designed system of engines, generators and rotaries and switchboard arrangements, this system can be operated with entire satisfaction in a combined lighting and power plant.

The discussion following was interesting, and developed a suggestion from Mr. White, of Cincinnati, that in buying an alternator, either single-phase or two- or three-phase from which it is intended to supply any motor service, the question should be carefully considered whether one wants to buy an inductor alternator. A motor load, on account of the power factor of such induction motors as are now on the market, has a very bad effect on the regulation of any dynamo. The inductor alternator is supposed to have a close inherent regulation, but the regulation cannot be controlled by the operator within any wide limits; and as the inherent regulation will not take care of an inductive load the quality of your lighting service will be very seriously interfered with if an inductive load is put on an alternator of this type.

Mr. Schmidt remarked that his company was about to install a 100-kw inductor alternator. It had a Bristol recording voltmeter in circuit, and he would be prepared later on to relate its experience as to whether it would regulate or not.

Mr. Peck concluded the discussion by saying that this reactance seemed to have little effect upon the regulation with lamp load. For example, if the reactance of the alternator is 28 per cent with a lamp load, the effect of this is to add but 4 per cent to the drop in voltage. With an inductive load, however, the effect of this reactance rapidly increases. Thus, with a load having even as high as .8 power factor, the reactance would add about 17 per cent to the drop in the generator, while with a lower power factor, which is the condition usually obtained when starting A. C. motors, the effect may be considerably increased, so that the total effect of the reactance may be to cause as high as 20 per cent or 25 per cent increased drop on the generator.

After a vote of thanks to authors of papers, the convention took recess until 1:45 p. m., at which time it reconvened, President Gaskill in the chair, and a paper was read by Capt. James M. Andrews, of the General Electric Company, Schenectady, N. Y.—subject, "Choice of Periodicity of Alternating-Current Apparatus."

A brief discussion followed. The next paper was by Mr. L. G. White, of the Columbus Edison Company, Columbus, Ohio, on "The Desirability of Using Storage Batteries in Medium Size Stations." Mr. White referred to the fact that storage batteries are recommended for their capacity to carry enormous loads for a short duration, what is termed the "peak." He contended that they were useful especially for a medium-sized station for evening-up variations in the load; in other words, for regulation.

A feature equally important is that storage batteries provide absolutely reliable reserve in case of accident to generating apparatus;

and in that connection he gave a graphic recital of the difficulties experienced upon one occasion when the pumps feeding the boilers were filled with a sudden influx of sharp sand, and the water gave out and fires had to be banked; pending remedy, the storage battery was called on, and nobly met the emergency. Mr. White had with him a number of charts covering four months' time, two months being taken with battery on and two off. The charts amply supported the position taken by Mr. White, and were examined with great interest by all present; they showed decided difference in the pressure. During the short discussion following, Mr. White called attention to the fact that a large part of the money realized from guarantee on storage battery was spent in traveling expenses and inspection, and a company maintaining its own plant would save that outlay.

Mr. M. E. Turner, of Cleveland, gave an informal talk on the subject of the application of the two-rate method of charging for current. (By request this was not reported.) Mr. W. F. White, of Cincinnati, read a very exhaustive and able paper on "Electricity vs. Gas;" or "Shall we keep abreast of the times; or shall we retrograde in methods of street illumination?" This paper was devoted principally to a discussion of the relative merits of electricity for street lighting as compared with Welsbach gas lamps for the same purpose. It showed that electric lighting for the illumination of all streets and public places is in universal favor, and that the demand for arc lights is so general in all cities that they are replacing very rapidly everywhere the older gasoline and gas lamps. It is shown that in about 60 per cent of all the cities in the United States of over 25,000 inhabitants gas has been entirely discarded, and electricity is now used exclusively for street lighting purposes; also, that the remaining 40 per cent of all the cities in the class named are rapidly reaching the same position. It is shown that electric arc lighting not only illuminates the streets more brilliantly and satisfactorily, but also at a less cost, and that where arc lights are used electric light companies make the entire investment; while where gas lamps are used the city has to bear the cost of the posts and fixtures and erection of same; and that this has almost universally been the practice. Photographs of streets lighted with Welsbach gas lamps and of streets lighted with arc lamps were shown in support of the argument that the electrically lighted streets are much more brilliantly illuminated. The costs per mile of street per year for the two kinds of illumination were figured out for given conditions, and statements made of these costs in some cities, showing that electric light is cheaper as well as better. A table of street lighting data for all cities in the United States of over 25,000 inhabitants was presented, giving the number of arc lamps and the amount of money paid for street lighting per 100,000 population in each city.

The paper was at once recognized as most able and comprehensive, and there were immediate inquiries as to how further copies could be secured by members. A vote of thanks was tendered to the writer of this and preceding papers.

The convention now went into executive session to consider some matters of routine, during which the report of Mr. A. W. Field, as secretary-treasurer, was submitted with the report of the auditing committee pronouncing same to be correct, and recommending a vote of thanks to Mr. Field, with especial reference to the fact that he had at serious loss of his own time undertaken the duties of Mr. J. Q. Brown, who was last year selected as secretary, but resigned owing to his leaving the State. The vote of thanks to Mr. Field was unanimous.

At 5 p. m. an adjournment to Thursday morning was taken after a very busy day, and a band concert was given in the Boody House by the Toledo Traction Company's Centennial Band of 40 pieces, composed entirely of employees of that company, under the management of Mr. A. A. Atkinson, of the Toledo Traction Company, a gentleman who has achieved some celebrity as the author of a poem, entitled "The Evolution of Light," which has been published in a number of journals, etc .

During the day's session the following gentlemen were named as nominating committee, with instructions to report Thursday morning, viz.: A. W. Field, Columbus, chairman; W. F. White, Cincinnati; A. F. Dickinson, Geneva, Ohio.

There was a profusion of entertainment for the ladies and others during the three days' session. The following is a brief outline of courtesies proffered by the Toledo Traction Company, who was the host: Tuesday afternoon, boat ride on the Maumee and Lake Erie to Gard Island, and trolley ride at 7:30 p. m.; Wednesday, tally-ho ride for the ladies at 10 a. m. to Ottawa Park and Golf Links; 2 p. m. for the ladies, launch ride to Perrysburg and Maumee up the river, in opposite direction from former boat ride; band concert at Boody House at 5 p. m. Evening—Trip to and entertainment at the Casino, compliments of Toledo Traction Company for Association and ladies. Thursday afternoon, visit to East Toledo, via trolley cars, to the plant of the Edward Ford Plate Glass Company Works at Rossford. The following facts regarding this plant may be of interest:

The Edward Ford Plate Glass Company is located at Rossford, about five miles from Toledo, and is the only plate glass plant operated by electricity. The plant consists of a battery of eight 500-hp Sterling boilers equipped with Playford & Murphy stokers; four 1000-kw and one 350-kw, three-phase alternator generators, 580 volts, of the revolving field type, direct-coupled to a McIntosh & Seymour compound engine, 27 x 54 x 42, 122 revolutions, and Russell & Company cross-compound engine, 30 x 60 x 30, 120 revolutions; one 300-kw motor generator set, consisting of one 300-kw induction motor direct-coupled to one 150-kw, 125 volts direct-current generator on one side, and one 150-kw, 330 volts, three-phase alternating generator on the other side.

This set is used for lighting purposes. One 100-kw, 125 volts, direct-current generator coupled to 150-hp Ball engine at 275 revolutions.

The grinding shed contains twenty 200-hp induction motors and twenty-four 100-hp induction motors. These motors are the first of this type to be operated successfully at variable speeds. There are also in this building four transfer cars operated by motors. The pumping station is equipped with four 50-hp induction motors direct-coupled to four Stilwell-Bierce triple pumps, 12 x 12, 50 revs. The machine shop, pot house, plaster house, mix house, and all smaller places are operated by induction motors, ranging from 5 horse-power to 50 horse-power each. Transfer cranes are equipped with 125-volt D. C. motors. The equipment is General Electric throughout, and was installed by Mr. Frederick B. Perkins.

At the closing session on Thursday morning, officers were elected as follows:

President, Ernest J. Bechtel, Toledo, Ohio; vice-president, Samuel Scovil, Cleveland, Ohio; secretary-treasurer, J. H. Perkins, Youngstown, Ohio.

Executive Committee—D. L. Gaskill, Greenville, Ohio; Emil G. Schmidt, Sandusky, Ohio; George Matt, Lancaster, Ohio; E. H. McKnight, Middletown, Ohio; George Hayler, Van Wert, Ohio.

Finance Committee—W. F. Raber, Mansfield, Ohio; S. M. Rust, Piqua, Ohio; E. F. Gwynn, Delaware, Ohio.

Advisory Committee—Samuel Scovil, Cleveland, Ohio; A. W. Field, Columbus, Ohio; H. C. Fogle, Canton, Ohio.

The recommendation of the Executive Committee was received and approved that Put-in-Bay be selected as the place of next annual meeting, the time to be arranged later by the Executive Committee.

Ordered that the proceedings of this meeting be published in pamphlet form for distribution to members.

Mr. H. W. Hillman, of Schenectady, N. Y., was unable to be present, and his paper, on "Arc Lighting," was read by Mr. W. F. White, of Cincinnati.

Following the reading and discussion of this paper a pleasant surprise was in waiting for Mr. Thomas H. McLean, of the local company, in the shape of a handsome silver loving cup, inscribed as follows:

"To Thomas H. McLean, from the Ohio Electric Light Association and Their Guests, Aug. 14, 15 and 16, 1900, Toledo, Ohio." The presentation was made in graceful terms by Mr. D. L. Gaskill, the retiring president of the Association.

Mr. McLean made a brief and modest reply, with much feeling.

Mr. White, of Cincinnati, made some witty remarks in further expression of the high appreciation in which the delegates held their hosts, and told some entertaining stories, which were heartily enjoyed.

Mr. Ernest Bechtel, the president-elect, thanked the Association membership for the honor conferred, deprecated his ability to fill it as worthily as his predecessor, and concluded by saying that the honor he would wear as one paid in compliment rather to his company than himself personally.

After an informal discussion as to the best means to increase membership, the convention adjourned sine die.

Members in Attendance.—A. A. Atkinson, Toledo Traction Company, Toledo, Ohio. Ernest J. Bechtel, Supt. Toledo Traction Company. Toledo, Ohio; supt. Toledo Consolidated Electric Company, Toledo, Ohio. G. N. Clapp, secretary-treasurer and manager Middletown Gas & Electric Light Company, Middletown, Ohio; secretary-treasurer and manager Washington Gas & Electric Company, Washing C. H., Ohio; president and treasurer Wilmington Gas Light & Coke Company, Wilmington, Ohio. Thomas H. McLean, president and general manager Toledo Consolidated Electric Company. Toledo, Ohio. A. F. Dickinson, Geneva Electric Light & Power Company, Geneva, Ohio. William P. Engel, The People's Gas & Electric Company, Defiance, Ohio. A. W. Field, Columbus Edison Electric Light Company, Columbus, Ohio. D. L. Gaskill, Greenville Electric Light & Power Company, Greenville, Ohio; George Hayler, Jr., Van Wert Electric Light & Power Company, Van Wert, Ohio. W. F. Hubbell, Wauseon Electric Light Plant, Wauseon, Ohio. Albion E. Lang, president The Toledo Traction Company and The Toledo Consolidated Electric Company, Toledo, Ohio. E. H. McKnight, president and general manager The Middletown Electric Light & Power Company, Middletown, Ohio; president and general manager The Bowling Green Electric Light & Power Company, Bowling Green, Ohio; vice-president and general manager The General Gas & Power Company, Connersville, Ind. Charles R. Lutz, Citizens' Electric Light Company, Logan, Ohio. George Matt, Lancaster Electric Light Company, Lancaster, Ohio. J. M. Plaisted, Columbus Electric Light & Power Company, Columbus, Ohio. L. A. Pool, Piqua Electric Company, Piqua, Ohio. W. F. Raber, Citizens' Electric Railway, Light & Power Company, Mansfield, Ohio. C. B. Rodgers, general manager The Tiffin Edison Electric Illuminating Company, Tiffin, Ohio. Emil G. Schmidt, Sandusky Electric Light Company, Sandusky, Ohio. F. E. Valentine, Urbana Electric Company, Urbana, Ohio. William F. White, general manager The Cincinnati Edison Electric Company, Cincinnati, Ohio. Thomas Espy, Kenton Gas & Electric Company, Kenton, Ohio. A. C. Blinn, Sandusky Electric Light Company, Sandusky, Ohio. J. H. Perkins, Youngstown Gas & Electric Company, Youngstown, Ohio. E. F. Gwynn, Delaware Electric Light, Heat & Power Company, Delaware, Ohio. M. E. Turner, Cleveland Illuminating Company, Cleveland, Ohio. S. M. Rust, Piqua Electric Company, Piqua, Ohio.

Visitors, Etc.—Fred H. Froehlich and Frederick B. Perkins, of the Edward Ford Glass Company, Toledo, Ohio. J. J. Guenther, electrician Shelby Municipal Lighting Plant, Shelby, Ohio. W. M. Howe, Toledo Traction Company, Toledo, Ohio. Clyde Van Fleck, Oil Refinery, Toledo, Ohio. W. S. Smith, Toledo, Ohio. H. T. Yaryan, Toledo Heating & Lighting Company, Toledo, Ohio. H. Wellman, Ohio Valley Electric Railway, Ashland, Ky. Frank Hein, president Fremont Electric Light Company and Fremont Gas Company, Fremont, Ohio. Miss Campbell, Mrs. Bechtel, Mrs. McKnight, the Misses McKnight, Mrs. Rust, Mrs. Hanley, Mrs. Walton, Mrs. Porter, Mrs. Rodgers, Mrs. Engel, Mrs. Dickinson, Mrs. De Vor, Mrs. Espy.

Supply Men in Attendance.—Perry R. Boole, Electric Appliance Company, Chicago, Ill. Elton J. King, engineer Meter and Instrument Department, Fort Wayne Electric Works, Fort Wayne, Ind. P. C. Morganthaler, Fort Wayne Electric Works, Fort Wayne, Ind. Robert L. McOuat, represented by V. C. Grace, electrical supplies, Indianapolis, Ind. W. G. Nagel & Company, Toledo, Ohio. National Arc Lamp Company, Lorain, Ohio (Allyn B. Walton). W. D. Packard, secretary New York & Ohio Company, Warren, Ohio. William M. Porter, sales agent, Lea Electric Manufacturing Company, Elwood, Ind. M. O. Payne, central station plants for hot water heating, La Porte, Ind. John Sedgwick Peck, Westinghouse Electric Manufacturing Company, Pittsburg, Pa. A. J. Stahl, central plants for hot water heating, La Porte, Ind. W. L. Wood, General Electric Company, Boston, Mass. E. K. Patton, western manager Perkins Electric Switch Lever Company, Chicago, Ill. F. Bissell, The F. Bissell Company, Toledo, Ohio. E. J. Paradis, of W. G. Nagel & Company, Toledo, Ohio. J. L. Merrill, General Electric Company, Cincinnati, Ohio. H. T. Stewart, General Electric Company, Columbus, Ohio. W. J. Hanley, General Electric Company, Cincinnati, Ohio. H. E. Adams, Illinois Electric Company, Chicago, Ill. Capt. J. M. Andrews, General Electric Company, Schenectady, N. Y. H. W. Hillman, General Electric Company, Schenectady, N. Y. W. A. Hopkins, Jr., manager The Erner-Hopkins Company, Columbus, Ohio. Allen S. Pearl, Central Electric Company, Chicago, Ill. C. M. Hamilton, The F. Bissell Company, Toledo, Ohio.

Telephone Meters versus the "Measured Rate."

By D. W. Bliss.

With the expiration of the so-called fundamental patents, the use of the telephone has increased wonderfully, and the figures given by both the Bell and opposition companies show that with the general extension of toll lines and reduction of rates the telephone is fast becoming a necessity in the homes and offices of those who a few years ago would have viewed it as an expensive and altogether unnecessary luxury.

The question of rates and the method of charging in different classes of service, however, is a troublesome and complicated matter in most exchange systems, and a greatly increased business could undoubtedly be obtained by both city and country exchanges if some uniform and proportionate system of rates should be established and maintained, without unduly increasing the operating expenses. The class of service such rates would secure would consist largely of those of moderate means and small tradesmen.

With the party-line system now in vogue, the cost of the distributing plant is not excessive, but is in fair proportion to the business that should be secured on this kind of service. The operating expenses are, however, relatively high at present, as the measured rate system, which so far is the only practical scheme for such service, diverts a large share of the operator's time from her proper use, namely, making prompt and satisfactory connections. There is, moreover, the inevitable personal factor in the present system of measuring by hand that must lead to errors in favor of or against the company, as the case may be.

Leaving out the question of counting connections, and keeping tabs on the subscribers the average labor charge for making connections is small as compared with the plant investment in any given system of this type.

It would seem, therefore, that, as the calling subscriber practically leases the circuit for a variable length of time, including the service of the operator, which is only a small and fixed charge, a system of rates based on the time the line is used, would in all cases be the fairest to the subscriber and the most profitable to the company.

If a simple, accurate and inexpensive meter were devised, that could be connected with each subscriber's telephone, showing him clearly, as well as the inspector, the total length of time the line had been used for outgoing service during the month, and if this could be accomplished without increasing the present complexity of the switchboard or making any extra demands on the time of the operator, a large and profitable business could be secured. This, of course, is no small problem, and it has occupied the attention of telephone engineers for some time, but it will eventually be solved, and the day is probably not far distant when the telephone meter will take its place with the electric light, gas and water meters.

Leading Awards at the Paris Exposition.

The list of awards to American exhibitors at the Paris Exposition was made public in Paris on Aug. 17. The United States received 1981 awards. Of these, 220 were grand prizes, 486 gold medals, 583 silver medals, 270 honorable mentions, and many gold, silver and bronze medals for collaborators. Every line of American industry and art is recognized.

United States Commissioner-General Ferdinand W. Peck has been appointed a grand officer of the Legion of Honor, his appointment having been announced in the Official Journal on Aug. 17.

Among the electrical exhibits and exhibits of allied industries the following received grand prizes or gold medals: Department of Liberal Arts, Group III—Ferracute Machine Company, Brown & Sharpe Manufacturing Company. Department of Machinery, Group IV—Grand prizes—Worthington Pumping Engine Company, Batcheller Pneumatic Tube Company, Brown & Sharpe Manufacturing Company, Pratt & Whitney Company, E. W. Bliss Company, Niles Tool Works Company, J. A. Fay & Egan Company. Gold medals—Bail Engine Company, William Sellers Company, George F. Blake Manufacturing Company, Tinius Olsen & Co., Otis Elevator Company, Rand Drill Company, Charles A. Schieren & Co., Crane Company, Ingersoll-Sergeant Drill Company, Shaw Electric Crane Company, Simonds Manufacturing Company, Chicago Pneumatic Tool Company, Morse Twist Drill & Machine Company, Cincinnati Milling Machine Company, Hendy Machine Company, Warner & Swasey, Norton Emery Wheel Company, Bement-Miles Company, E. C. At-

kins & Co., Gisholt Machine Company, Jones & Lamson Machine Company, F. E. Reed Company, Deering Harvester Company, Bullard Tool Company, Pond Machine Tool Company.

Department of Electricity, Group V—Grand prizes—American Steel & Wire Company, E. C. Acheson, Rowland Telegraphic Company, Western Electric Company, John A. Roebling's Sons Compand. Gold medals—Bullock Electric Manufacturing Company, Lorain Steel Company, Western Electric Company, Alvin Manufacturing Company, National Carbon Company, Tiffany Glass & Decorating Company, C. J. Toerring Company, Ward Leonard & Co., Helios-Upton Company, Holophane Glass Company, Hart & Hegeman Manufacturing Company, Edison Phonograph Company, Western Electrical Instrument Company, Mica Insulator Company.

Department of Civil Engineering and Transportation—J. G. Brill Company, Standard Electric Company of California, American Electric Vehicle Company.

Grand prizes and gold medals, Group, II—Mining and Metallurgy—American Steel & Wire Company, M. C. Bullock Manufacturing Company, Jeffrey Manufacturing Company, J. A. Roebling's Sons Company.

Department of Varied Industries—Groups XII and XV—Holophane Glass Company, Automatic Electric Clock Company.

Department of Chemical Industries—Group XIV—Vacuum Oil Company.

Insulation by Freezing.

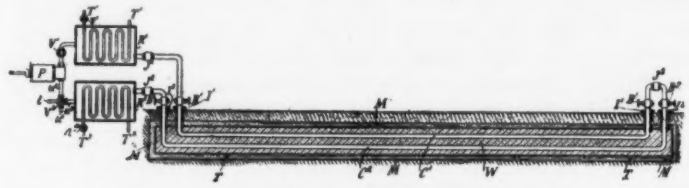
As is well known, the subject of insulation is always more or less in Mr. Nikola Tesla's thoughts and has been made the subject of several of his inventions. It is interesting to note that he has now taken out a patent in which he utilizes the insulating effects of freezing, etc. Referring to the original work of Faraday, who estimated water and aqueous solutions to insulate a hundred times better when frozen solid, he says that in the course of his own investigations he has not only confirmed this, but ascertained (1) that under certain conditions, when the leakage of the electric charge ordinarily taking place is rigorously prevented, ice proves itself to be a much better insulator than has heretofore appeared; (2) that there is benefit in adding other bodies to the water; (3) that the dielectric strength of such ice increases with the reduction of temperature and corresponding increase of hardness; (4) that there is most gain in regard to intermittent or alternating currents at high rates, very thin slices of ice being capable of enduring electromotive forces even into thousands of volts. Upon this and other data Mr. Tesla bases some ingenious applications, as illustrated in his patent. In carrying out his method, he employs a hollow conductor and passes the cooling agent through it, or he uses expressly for the circulation of the cooling agent an independent channel and freezes the adjacent substance in which any number of conductors may lie.

Most frequently in the distribution of electricity for industrial purposes by alternate currents more than one conductor will be required, and in such cases it may be convenient to circulate the cooling agent in a closed path formed by the conductors. A plant of this kind is illustrated in the figure in which C' and C^2 represent two hollow conductors embedded in a frozen mass underground and communicating respectively with the reservoirs R' and R^2, which are connected by a reciprocating or other suitable pump P. Cooling coils or tubes T' T' and T^2 T^2 with regulating valves v' v'' are employed. A three-way valve V^2 is provided, which when placed with its lever l as indicated allows the cooling agent to enter through the tubes u' u^2 and pump P, thus filling the reservoirs R' R^2 and hollow conductors C' C^2; but when turned 90 degs. the valve shuts off the communication to the outside through the tube u' and establishes a connection between the reservoir R^2 and pump P through the tubes u^2 and u^3, thus permitting the fluid to be circulated in the closed path C' C^2 R^2 u^3 u^2 P R' by the action of the pump. Another valve V' of suitable construction may be used for regulating the flow of the cooling agent. The conductors C' C^2 are insulated from the reservoirs R' R^2 and from each other at the joints J' J^2 J^3, and they are, furthermore, protected at the places where they enter and leave the ground by flanged bushings I' I' I^2 I^2, of insulating material, which extend into the frozen mass in order to prevent the current from leaking, as above explained. Binding posts B' B' and B^2 B^2 are provided for connecting the conductors to the circuit at each station.

In laying the conductors, as C' C^2, whatever be their number, a trench will generally be dug and a trough, round or square, as T, of smaller dimension that the trench, placed in the same, the intervening space being packed with some material (designated by M M M) more or less impervious to heat, as sawdust, ashes, or the like. Next, the conductors will be put in position and temporarily supported in any convenient manner, and finally the trough will be filled with water or other substance W, which will be gradually frozen by circulating the cooling agent in the closed path, as before described. Usually the trench will not be level, but will follow the undulations of ground, and this will make it necessary to subdivide the trough in sections or to effect the freezing of the substance filling it successively in parts. This being done and the conductors thus insulated and fixed, a layer of the same or similar material M M M will be placed on the top and the whole covered with earth or pavement. The trough may be of metal, as sheet-iron, and in cases where the ground is used as a return circuit it may serve as a main or it may be of any kind of material more or less insulating.

Mr. Tesla also illustrates a plan of immersing the primary and secondary of transformers in a freezing jar.

Another plan is that of a pipe or conduit through which the cooling agent may be driven, thus freezing the water or mixture around a number of conductors in it. In some instances, it would be sufficient merely to embed the conductors in a moist mass of cement, etc., and keep it at a low temperature of frost. Mr. Tesla remarks that the temperature of the conductor will be determined by the nature of its uses and considerations of economy. For instance, if it be employed for the transmission of telegraphic messages, when the loss in electrical friction may be of no consequence, a very low temperature may not be required; but if it be used for transmitting large amounts of electrical energy, when the frictional waste may be a serious draw-



INSULATION BY FREEZING.

back, it will be desirable to keep it extremely cold. The attainment of this object will be facilitated by any provision for reducing as much as possible the flowing in of the heat from the surrounding medium. Clearly the lower the temperature of the conductor the smaller will be the loss in electrical friction; but, on the other hand, the colder the conductor the greater will be the influx of heat from the outside and the cost of the cooling agent. From such and similar considerations the temperature securing the highest economy will be ascertained.

Convention of Municipal Electricians.

Mr. Morris Mead, the chairman of the executive committee of the International Association of Municipal Electricians, which will hold its fifth annual convention in Pittsburg on Sept. 25, 26 and 27, has now completed the programme for the coming meeting. He has also finished all arrangements towards entertaining the guests. The programme has been gotten up in the shape of a very attractive little booklet handsomely printed and strongly bound. This booklet contains, in addition to the programme, a large amount of useful information about the city of Pittsburg, its electrical and other industries, all of which is of interest to everybody.

The following are the papers to be read during the three days' session: "Benefits to be Derived from Our Association," by Captain Wm. Brophy, of Boston Mass.; "Contact Points," by Frank C. Mason, of Brooklyn, N. Y.; "Trials and Troubles of Instituting and Enforcing Municipal Inspection and Control," by M. G. Canfield, Grand Rapids, Mich.; "Automatic Fire-Alarm Systems," Charles Burger, Boston; "Advantages and Disadvantages of Carrying High and Low Potential Conductors upon the same Poles," by an "able electrician."

The headquarters of the convention will be at the Monongahela House. There will be two sessions each day, at 9:30 a. m. and at 2:30 p. m. During the afternoon of the 25th there will be a trolley ride on special cars. During the afternoon of the 26th there will be carriage rides over the boulevards and through the parks for the lady guests to the convention, and in the evening there will be theatre parties and inspection of some of the large iron and steel mills of the city. On

the 27th there will be a river excursion on the Ohio River to Davis Island Dam.

The entertainment committee consists of all the municipal electricians of both cities, Allegheny and Pittsburg.

CURRENT NEWS AND NOTES.

MOVING A HOUSE BY TROLLEY.—The experiment of moving a house by electric power taken from a trolley line was recently successfully tried in Wellsville, Ohio. The house was being moved along a street occupied by the street car line. A couple of cars were hitched to it by a rope and it was quickly pulled to its destination.

SURVEYING FOR PHILIPPINE CABLE.—The United States tug Iroquois returned to Honolulu on the 5th from her survey trip to the Midway Islands to investigate the practicability of locating one of the stations of the proposed Philippine cable on the Midway Islands. Lieutenant Charles Pond, who was in charge of the expedition, will report in favor of the station being located at Sand Island, the western and larger of the two islands.

CONGRESS DELEGATES.—American delegates to congresses in Paris are the following: Electrical Congress—Major John Millis, U. S. A., Mr. Carl Hering, Francis E. Drake, A. E. Kennelly, Prof. Sydney H. Short. Physical Congress—Prof. Alex. Graham Bell, Dr. Cleveland Abbe (Weather Bureau), Prof. J. S. Ames (Johns Hopkins), Major John Millis. Tramway Congress—Prof. Geo. S. Wilkins (Alabama), Walter S. Allen (Massachusetts State Commission).

WORK ON THE NEW YORK SUBWAY.—The New York Rapid Transit Commission has established a branch office at Pittsburg, Pa., for the purpose of expediting the delivery of steel and iron for the construction of the subway. The contract for the structural steel is held by the American Bridge Company, and the first shipments are now on the way to New York. At the present time, about 300 ft. of excavating has been done on the subway, but no tunneling has been started by the sub-contractors.

DETROIT'S MUNICIPAL PLANT.—The annual report of the lighting commission shows that the operating expense of the city's plant for last year was $90,087.73, representing a saving of $6,577.30, as compared with the previous year's work. The output was 249,483 kw-hours in excess of that of the previous year. Incandescent lamps consumed 461,597 kw-hours and the arc lamps 3,327,453, making a total of 3,789,050. The gross cost of operating each arc lamp was $66.31, as compared with $75.56 the previous year, showing a saving of $9.25 per light. The plant is being repaired, and the cost of the improvements will be charged to the account of operation for the coming year, which will likely increase the cost per lamp materially.

PACIFIC COAST TELEPHONY.—One of the largest combinations of capital ever effected on the Pacific Coast is about to go into operation. All the Bell telephone companies in California, Oregon, Washington, Nevada, Idaho and Arizona have been consolidated, the new corporation being the Pacific States Telephone & Telegraph Company. It is capitalized at $15,000,000. Of this $10,000,000 has been issued to stockholders in the old corporations, and $5,000,000 is held in trust to provide for future extension and improvements. The companies entering the consolidation are the Sunset Telephone & Telegraph Company, Pacific Telephone & Telegraph Company, the Oregon Telephone & Telegraph Company and Inland Telephone & Telegraph Company.

TO CONSIDER PNEUMATIC TUBES.—The Postmaster General has issued an order directing a general investigation as to the cost of construction, operation and utility of all pneumatic tube systems for transmission of mails. This investigation is designed to enable Congress to determine whether the pneumatic tube service should be owned, leased, extended or discontinued by the Government. There is an appropriation of $10,000 for the investigation which will be conducted in a few of the principal cities of the country, including probably New York, Chicago, Boston, Philadelphia, St. Louis, San Francisco and New Orleans. It would be worth the while of the commission to examine also into the feasibility of modern electric telpherage methods.

TELEPHONING AN OCEAN LINER.—An automatic telephone pay station has been tried on board the Hamburg-American line steamship Augusta Victoria, at the pier in Hoboken. All that is necessary to be done to connect the steamer with the telephone system is to insert a plug in its proper place on the deck. This is the work of a second. No attention from the telephone company's employees is required. The connection is made with the Hoboken central office. The system gives passengers leaving for Europe opportunity to transact business up to the very moment of sailing, as it is designed to disconnect the telephone at the same moment the lines are cast off. If the scheme works well similar stations will be placed on the other steamers of the Hamburg-American line.

VENTILATION OF LAUNCHES.—Mr. J. C. Chamberlain, electrical engineer, whose pioneer work in the field of electric launches is well known, has patented a method of ventilating such craft by placing a funnel forward of the well so that a continual supply of air can be led over the batteries and motors all placed below the deck. This enables the complete encasement of the driving power in the boat structure. He also has an improved anti-frictional journal bearing, adapted to take with a minimum of friction the end thrust of the propeller shaft, there being two sets of balls in cages. A further improvement is a system for connection with the battery or outside charging terminals, so that when the detachable plug is taken away the circuits cannot be closed by unauthorized persons.

SECRETARY HAY AND THE TELEPHONE.—Mr. Hay is one of the most polite and patient of men. He likes to be helpful to newspaper correspondents, and receives them freely in his office, and gives them such information and hints as the proprieties will permit. Even the representatives of the sensational papers are treated with courtesy, though naturally with due caution. Imagine the Secretary's surprise one afternoon during the heat of the Chinese crisis, when he was up to his ears in work and anxiety, to hear from the lips of William, his faithful messenger, these words: "Mr. Secretary, the New York Blank wants you to step to the telephone." Mr. Hay gasped, caught his tongue in the nick of time, recovered his diplomatic urbanity, and replied: "Say that the Secretary expresses deep regret that just at this moment he is very much engrossed in important work." Unfortunately, what he said under his breath could not, under the rules of the telephone exchange, be sent over the wires.

AUTOMOBILES IN CITIES.—In a recent discussion before the Boston Society of Civil Engineers, Mr. Knight Neftel, manager of the New England Electric Vehicle Transportation Company, said: The result of one year's operation in Boston has been as follows: The present plant of our company has been in operation since Oct. 2. So far we have traversed the streets of Boston to the extent of 112,000 miles, adding about 2000 or 3000 miles a day to this total. We handle, in storage batteries, from 400 to 500 tons every day in our station. We operate about 154 automobile vehicles of various kinds, and we are adding about 60 more to be used for delivery wagon purposes. For the charging of our batteries and the operation of this plant we are taking 100,000 kw-hours of current per month, and I am happy to say that we are just getting clear of our pay rolls and other expenses. In other words, the service, I think, has proved popular with a great majority.

TO SAVE NEW HAVEN'S ELMS.—A conference in New Haven has been called by Mayor Cornelius T. Driscoll, and Director Alexander Troup of the Department of Public Works, in order to devise means of saving the old elms of the city. The prolonged drouth has accentuated the evidences of general decay, and the city government has at last awakened to the necessity of action. The State Agricultural Experiment Station has for several weeks been at work on the matter. An expert from there, Dr. A. B. Jenkins, will, at a general conference of citizens, to be held shortly, give the result of his observations. The officers of the street electric railroads, Electric Light Company and the Gas Distributing Company, have been invited as a body, and personal letters to leading citizens have gone out from the mayor's office asking them to be present. Is it permanent pavements, or leakage from gas mains, or induction

currents from the trolley wires, or the elm-tree beetle that killed the elms? are the propositions to be discussed. In view of the fact that one-third of the elms on the Central Green are dead or dying, the matter is of great importance.

IMPROVEMENT IN ARC LAMPS is the subject of a patent issued to B. A. Stowe and assigned to the Jandus Electric Company. Several objects are arrived at, notably the use of the choke coil in an alternating or pulsating current lamp to control the carbon movement, and thus also to dispense with electromagnets and solenoids. Other features are the reduction in the number of parts, and detaching the two globes simultaneously in an enclosed arc. The invention, which has 28 claims, consists broadly in the combination of a clutch, a stationary inductive resistance comprising a slotted choking coil and a core having two poles, and a movable coreless coil mounted to approach and recede from the maximum density of the field of force between the poles of the inductive resistance, and having its ends connected to the coil of the resistance, so as to be in circuit therewith, whereby the e. m. f. of the coil will vary in direct proportion to the variations of the e. m. f. in the coil of the inductive resistance, and connections between the coil and the clutch. Means are worked out to utilize approximately the movements of the working coreless coil to regulate the operation and burning of the lamp.

MANUFACTURE OF CALCIUM CARBIDE.—Attention has been called from time to time to the success of Mr. W. S. Horry in the production of calcium carbide. His processes are being worked by the Union Carbide Company, of Niagara Falls. Mr. Horry has now had issued to him patents descriptive of his method of using motors to insure the automatic regulation of the furnaces, so that several of them can be manipulated from one point and by one set of apparatus, instead of a motor for each furnace. Moreover, a slow and even movement of the regulating element of the furnace is undesirable, because it causes the mixture in the furnace to form an arch which delays the response of the furnace regulation. It is one object of Mr. Horry to obviate these defects and disadvantages and to provide for shifting the regulating element of the furnace with a quick, jerky motion, which causes the mixture to fall at once into the zone or region of reduction. It will be remembered that Mr. Horry employs a furnace in which the electrodes remain fixed, so that his moving element is the receptacle itself in which the crude materials are placed. This receptacle he revolves by ratchet wheels, the engaging bar being driven by motor, the operating devices being governed by relays, so as to keep the furnace current approximately constant.

THIRD-RAIL ROAD.—The first trip over the new third-rail system of the Albany & Hudson Railway, operated by power from the new water-power station at Stuyvesant Falls, was made on Aug. 20, and the working of the new electrical plant proved satisfactory in every particular. At points along the route the train ran at the rate of 60 miles an hour. The train was under perfect control, and the speed could be changed at will. The line belongs to the Albany & Hudson Railway & Power Company. The latter company purchased the Kinderhook & Hudson Railway, which has heretofore been operated by steam power. The new owners have remodeled the system and have extended the line from Niverville, the previous terminus of the road, to Rensselaer, an additional distance of 18 miles. The total length of the new road from Hudson to State Street, Albany, is nearly 38 miles. New steel rails have been laid and the roadbed has been newly ballasted according to the best modern practice for high-speed service. The current is supplied by a third rail. Current is transmitted at a pressure of 12,000 volts to sub-stations along the line of the railway. The construction of the road has cost $2,500,000. The officers of the road are: A. M. Young, of New York, president; Maurice Hoopes, general manager; Ernest Gonzenbach, chief electrical engineer; Thomas Cochrane, chief of right of way department.

THE CANADIAN ELECTRICAL ASSOCIATION.—Among the papers to be read at the convention of the Canadian Electrical Association, which will be held in Kingston, Ont., on Aug. 29, 30 and 31, are the following: "Utilizing the Available Central Station Capacity," Prof. R. B. Owens, McGill University, Montreal; "Use of Dynamo and Storage Battery in Telegraph Offices," W. J. Camp, Montreal; "Power Factor as Affecting Operation and Investment, with Special Reference to Induction Motors and Inclosed Arc Lamps," F. H. Leonard, Jr., Montreal; "Government Electrical Standards," O. Higman, Ottawa; "Railway Subject: Giving Several Curves Showing the Average Power During a Day, and Maximum and Minimum Requirements for Power Called for on the Quebec System," Mr. Blair, Quebec; "Rotary Converters," A. Gordon Grier and J. C. Hyde, Montreal; "Conditions Affecting the Wave Form of Alternators," Prof. L. A. Herdt, McGill University, Montreal. The City Council of Kingston has appropriated a sum of money for entertainment purposes, and has granted the use of the City Council chamber for the sessions, also space in the City Hall for exhibits of electrical appliances, while the local electrical companies have agreed to furnish, free of charge, current and labor to exhibitors. Visitors will be given a trip through the Thousand Islands.

LUMINOUS EARTH FILAMENT.—A patent has been granted to Mr. G. Ahlfeld, of Darmstadt, Germany, on a material or filament for incandescent lamps, of the generic Nernst type. With a mold he forms a luminous earth mixture into the shape desired, preferably a hollow cylinder or a curved tube. He then heats it to redness, preferably in a muffle, by which it gains materially in hardness and consistency. After cooling, a ceramic lustrous preparation of one or more of the highly-infusible metals of the platinum group in mixture or solution with an ethereal oil is applied to the to-be-incandescent body in the form of a stripe or in such other form as is best adapted to the form of the incandescent body. If the incandescent body is in the form of a tube or hollow cylinder, he coats the interior surface with the mixture or solution. He then burns the ceramic lustrous preparation in by heating after the manner generally in use in the ceramic industry. Thus he obtains upon the said incandescent body a thin, firmly-adherent strip or film of metal, which when the incandescent is placed in circuit serves in the first instance to conduct the current, and thus heat the incandescent body which itself becomes a conductor, when the current passes through the incandescent and heats it to incandescence. Owing to the highly-refractory character of the metal strip or film employed for the initial heating current, it is not dissipated or destroyed by the passage of the current nor does it require to be cut out of the current when the lamp is in operation.

ARC LIGHT CARBON.—Mr. W. J. Burke, of Scranton, Pa., is the patentee of a new carbon for arc lighting, etc., which, it is claimed, burns equally well in open and enclosed arcs. The composition includes anthracite coal in the form of an impalpable powder and just enough of an oleaginous substance, such as gas tar, to moisten or dampen the powder. These ingredients are treated in the following manner: The anthracite coal is first reduced to an impalpable powder, or the impalpable powder around anthracite coal breakers or washeries may be employed, and this powder is heated in an iron vessel having a loose cover for the escape of gas or vapor. This powder is heated to about 125 degs. to 150 degs. F., and the heat is kept up until the mass is evenly heated throughout. The tar or other oleaginous substance is placed in a separate vessel and heated to the same degree as the powder. Just enough of the heated tar is now added to the powder to moisten or dampen it, and the mass is stirred until thoroughly mixed and the powder permeated by the tar, the heat being continued during this mixing. The heated mass will now be placed in heated molds of any desired shape or size, and the amount of pressure will also be governed by the density or porosity required in the article. The molds are thus heated or warmed to prevent any chilling or setting of the material operated on or treated. The filled molds will now have their tops applied, and the tops will be loosely covered with clay or other suitable material and placed in a retort, oven or furnace, where they are subjected at first to a low heat which is gradually increased to about 210 degs. F., at which it will be maintained for from 10 to 24 hours, according to the kind of carbon required. It will be seen that the material being treated is protected from the atmosphere and from the direct action of the heating medium, as it is confined within the molds. By thus graduating the heat and protecting the material in the molds changes take place in the constitution of the coal and cause it to cake, after which the heat is steadily increased until it reaches a degree equal to red-hot iron, at which it is continued until all impurities are driven off in the form of gases, when the heat is turned off and the molds and their contents are allowed to gradually cool. The result attained is said to be an electrical conductor of substantially pure carbon from anthracite coal, which contains prior to this treatment only about 80 per cent carbon and is a non-conductor of electricity. All necessity for coked material at the beginning of this process is obviated, as the coking and converting into carbon take place in the molds.

NORTH CAROLINA AGRICULTURAL COLLEGE.—A handsome building for the electrical engineering department of the North Carolina Agricultural and Mechanical College is being completed at Raleigh. It will be provided with the latest types of the various makes of dynamos and other machinery. A 40-hp Skinner automatic engine will be installed.

LETTERS TO THE EDITORS.

The Metric System.

To the Editors of Electrical World and Engineer:

SIRS:—In the columns of the ELECTRICAL WORLD AND ENGINEER for July 28 is an editorial article on "Rationalizing Electromagnetic Units," from which it is to be inferred that the metric system is without legal validity in the United States of America. Permit me to point out that the United States Government adopted the metric system in 1892. C. H. VON B.

PARIS.

[What we said was that "the governmental adoption of the metric system was *in reality* yet a thing of the future." This we take to be strictly true, meaning, as the article did, insistence on the practical, every-day use of systems and units. That was the drift and point of the discussion.—EDS. E. W. AND E.]

Pot Calling Kettle Black.

To the Editors of Electrical World and Engineer:

SIRS:—I note the dignified attitude of your journal toward the campaign of mud-slinging started against the electric light by some of the gas companies. It strikes me that the electric light can be trusted to take care of itself. All that is necessary is to point out its merits. The demerits of other illuminants will speak for themselves. Indeed, it is hardly necessary for you to go out of your way to emphasize the terrible chapter of gas disasters. I observe that at the meeting this week of the International Acetylene Association in Chicago, it is proposed to retaliate for the attacks made upon that illuminant by gasoline lamp advocates. There has been prepared a long string of questions asking for data as to gasoline lamp accidents, inquiring whether any anonymous circulars against acetylene have been circulated in the members' vicinity, and suggesting that it might be well to consider a similar line of attack on gasoline. Let pot call kettle black in this way, while we await with interest the data elicited.

MT. POCONO, PA. EDISONIAN.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

Temporarily Conducted by E. F. ROEBER, Ph. D.

DYNAMOS, MOTORS AND TRANSFORMERS.

REFERENCES.

Induction Motors.—EBORALL.—Continuation and conclusion of the illustrated reprint in full of his Brit. Inst. Elec. Eng. paper (Digest, Aug. 11).—Lond. *Elec. Eng.*, July 27, Aug. 3. A reprint of the paper begins also in Lond. *Elec. Rev.*, July 27.

Theory of Induction Motors.—A longer communication by Behrend, and a brief reply by Heyland, on the priority for the deduction of the so-called Heyland diagram.—*Elek. Zeit.*, July 12, 26.

LIGHTS AND LIGHTING.

Street Lighting by Series Alternating Current Arc Lamps.—A. L. RICE.—An illustrated article discussing the two methods available for that purpose: the series constant current system, or the constant potential system with lamps connected in series across the mains. In either case the lamps themselves are constant current arcs, and means must be provided for holding the current constant in each circuit of lamps. For the first method such a means is a transformer for each circuit, taking varying current at constant e. m. f. and delivering practically constant current at varying e. m. f.; for the second method an inductive regulating device may be used in each set of arc lamps in series connected across the constant voltage mains. He reaches the conclusion that both systems are practical and capable of giving good results. The cost is not materially different, but is slightly in favor of the parallel-series distribution with inductive regulators. This apparent advantage might easily be more than balanced by the greater flexibility of the transformer system and its greater convenience for a scattered arrangement of lamps. For a compactly arranged distributing system of circuits carrying full load during a large part of the lighting hours, the regulator system would be the better; for a scattered load and with full load on the circuits for a considerable portion of the time, the transformer system is the better. Neither is well adapted to a system where a light load is on the circuits for long periods.—*Am. Elec.*, August.

REFERENCES.

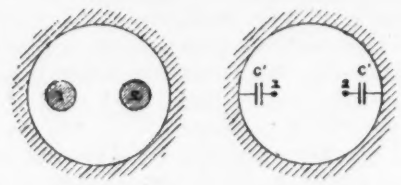
Connections of Arc Lamps for a 220-Volt Supply.—MATHIESEN.—An illustrated paper read before the Electrotechnical Society of Leipzig, in which he discusses the various methods of connecting arc lamps in a 220-volt supply, and describes different types of arc lamps of Koerting and Mathiesen for that purpose (see also Digest, Feb. 10).—*Elek. Zeit.*, July 12.

Test of Incandescent Lamps for Railways.—A note stating that one of the largest street railway companies in Massachusetts is making a test of the life of incandescent lamps of different makers. The company's specifications call for a 4-watt lamp giving an initial candle-power of 15 to 17, taking initially 60 to 66 watts at 110 volts, no lamp to drop below 25 per cent of the initial candle-power within 1000 hours.—*St. R'y Jour.*, Aug. 4, and Int. Ed., August.

Electric Gas Lighting Device.—A brief illustrated description of a device of Chomeau. A gasoline lamp has attached a little dynamo, consisting of a fixed permanent magnet and an armature able to revolve. By pulling rapidly a chain, a spark is produced between the gasoline lamp and lever which is pulled up by the chain.—*La Nature*, July 21.

POWER.

Charging Current of Transmission Lines.—GUYE.—A continuation of his theoretical investigation (Digest, Mar. 10). He shows how to calculate the charging current in symmetric cables for polyphase transmission lines. He supposes that the variations of voltage are sufficiently slow, so that there is electrostatic equilibrium in each moment. This supposition allows to apply the equations of electrostatic equilibrium to the case of conductors or cables acted upon by polyphase e. m. fs. He develops the general equations and treats the following special cases: For a cable, consisting of two conductors and supplied with single-phase alternating current, he shows that, regarding the charging current, the complicated effects resulting from the capacity of the cable may be represented by the action of two ideal condensers each connected between one conductor and the armature, as shown in the adjoining diagrams. He then treats the case of a



DIAGRAMS OF CABLES.

cable consisting of four conductors and supplied with two-phase current; and the case of a cable of three conductors, supplied with three-phase current; the results obtained are exactly analogous to the case of single-phase current. The capacity of the ideal condensers depends upon the coefficient of capacity of one of the conductors and upon the coefficient of electrostatic induction of two conductors. In general the calculation of these coefficients is extremely difficult; but he shows that the capacity of the ideal condenser can be easily determined by measurement by means of a ballistic galvanometer. He has determined the capacity of the ideal condensers for three different

three-phase cables of French make of given dimensions; he found the capacities of the ideal condensers at 0.1675, 0.1967 and 0.108 microfarad. The advantage of his method is that thereby the graphical treatment of the problems is greatly simplified.—*L'Eclairage Elec.*, June 16.

Regulation in Long-Distance Transmissions.—PERRINE.—A paper read before the Pacific Coast Elec. Transmission Ass'n, in which he discusses the various points which must be considered to render the service satisfactory. In order to keep the periodicity constant, the regulation of the water-wheels must be such as will maintain constant speed; the different methods of regulation with high and low head wheels are discussed. He suggests for high head plants the subdivision of water-wheels and the use of extremely high speed machinery. In the generators a wide range in the possible voltage variation is required; both generators and transformers must be designed not for good non-inductive load regulation, but for good inductive load regulation. The line should be designed for the smallest possible capacity current without reference to any attempt at balancing the line capacity against the load lag. Finally the use of reactance coils at the sub-station and a wide range of regulators in feeder circuits are recommended.—*Jour. of Elec.*, July.

Transmission System Regulation.—CORY.—A paper read before the Pac. Coast Elec. Transmission Ass'n, in which he considers the conditions of a three-phase current transmission of 10,000 kilowatts over a distance of 150 miles, which represents the case of an actual transmission line of the Standard Elec. Co. of Calif., the three conductors being aluminum wires. The frequency adopted is 60 periods per second; for comparison, he gives also the constants of the line if the frequency would be 30; he calculates the resistance and the inductive reactance per mile, the watt loss in transmission, and the voltage drop for a voltage of 60,000 at the transmitting end. He then calculates the capacity reactance per mile and the charging current. To show the effect upon the regulation, he assumes a 150-mile single-phase transmission, the frequency being 60 and the voltage at the receiving end 50,000; for considering the capacity effect, he first represents the line capacity by one condenser shunted across the middle of the line, and then by three condensers, in the middle and at the ends of the line. He notes that a long transmission line should never be started up with the receiver circuit open; the charging current is excessive, and this rise in voltage is a serious problem in insulation. He gives the current in various points of the line when 3000 kilowatts are delivered at the receiving end at unity power factor with a pressure of 50,000 volts; while the charging current at no load is more than 50 per cent of the full load power current, when the load is thrown upon the receiving circuit the resulting current is but 11 per cent greater than the required power current; this is an illustration of the advantage of closing the switches of a long-distance transmission only when there is a load upon the receiver circuit. He also gives the figures for the case of 3000 kilowatts delivered at the receiving end at a power factor of 0.8. He shows that for very long lines there must be used a method of producing inductive current to neutralize the capacity or charging current. The best way this can be done is with the use of induction motors, not alone at the end of the line, but throughout the entire length of the transmission system. Artificial regulating reactance coils may also be used, but under most circumstances a lowering transformer is necessary. By using these artificial reactance coils the voltage and current may be regulated at all loads. The use of induction motors, however, seems preferable in most practical transmission systems. One condition which must be avoided is a sudden reduction of load at the receiving end. The invariable result would be a large increase of charging current and an abnormal rise in voltage at the sub-station. An account of the extended discussion which followed is also given.—*Jour. of Elec.*, July.

REFERENCES.

Electric Cranes.—A continuation of the serial (Digest, Feb. 3). The question of one-motor versus three-motor cranes is discussed and some remarks are made about electrical switch gear.—Lond. *Elec. Rev.*, Aug. 3.

Electric Cranes.—MAGEE.—A well illustrated article on electric cranes in German harbors, describing installations at Hamburg and Bremerhafen.—*Cassier's Mag.*, August.

Cripple Creek.—DICKERSON.—An illustrated article on the application of electric power in the Cripple Creek district.—*Mod. Machinery*, July, August.

Electrically Driven Shops.—BROOK.—Some general remarks on electric driving of workshops. He recommends very good insulation of the armature. Brush rockers on motors he believes to be worse than useless, as the brushes are often left in the wrong place.—Lond. *Elec. Rev.*, July 27; reprinted in *El'ty*, Aug. 8.

TRACTION.

Polyphase Transmission for Railways.—L. BELL.—A communication referring to the great number of street railways using polyphase transmission and synchronous converters (Digest, June 16), and asking whether this is not being overdone. In the ordinary use of rotary converters there are to be encountered the aggregated losses in the transformers, the lines and the converters themselves; in these are consumed, under ordinary conditions of load, from 20 to 25 per cent of the energy input. This loss must in some way be compensated to attain an economical result, for instance, if cheap water power is available; but when steam power is to be used, such a big saving is not so easily obtained. The usual argument made to justify a transmission scheme, is that great saving is secured by generating the power at one point instead of at several points; but he doubts that this saving is in general great enough to compensate for the loss in the lines and in the transformers. If in the course of events it becomes generally feasible to use alternating motors for traction purposes, the case will resolve itself into a simple transmission problem, and a favorable solution will not be difficult to reach.—*St. R'y Jour.*, Aug. 4, and Int. Ed., August.

Small Electric Railways.—CAHOON.—The first part of a discussion of the question whether small electric railways can be operated at a profit. He states that of the 94 electric railways in operation in New York State during 1899, 41 showed an actual deficit, only 14 declaring dividends, of which only 4 were in small cities. In fact, electrical railroading in small cities is not profitable, which is due in part to the fact that many of the roads were equipped early in the history of electric railroading when the apparatus was poor, and have since been re-equipped, but have had to pay interest on the cost of the original equipment which has now no earning power. He discusses the possibility of increasing the traffic of such small roads by reduction of fares, establishment of parks, increase of speed, and other ways.—*St. R'y Jour.*, Aug. 4, and Int. Ed., August.

Southwest Missouri Electric Railway System.—A very well illustrated article on recent improvements in the Southwest Missouri Electric Railway, which is an interurban road about 31 miles in length extending through four or five cities in the zinc-mining district of Missouri. For a distance of about 19 miles especially fast trains are run which cover the distance with 10 stops in an hour, while the local cars take half an hour longer. Cars are run on part of the line every 30 minutes and on the other parts every 20 minutes. The cars are fitted with electric arc headlights which use 6½ amperes, and have been found to be excellent as preventives of accidents, particularly to cattle, which have been kept off the track by the brilliant light. The company has recently installed a new power station and is distributing power by the three-phase system. The main power station contains one 1200-hp engine which drives a 32-pole 25-cycle dynamo generating three-phase current at 11,000 volts. There are four sub-stations each containing a 250-kw synchronous converter. The method of starting up the converters in the morning is described.—*St. R'y Jour.*, Aug. 4, and Int. Ed., August.

Dusted Rails.—PARHAM.—An article on "grounded cars and dead rails," giving practical rules for motormen. A stop should never be made on dusty rails if it can be avoided. But when it has been done and the car refuses to start, nobody should be allowed to get on or off, as a severe shock can be gotten by doing so. The first thing to do, is to pull the trolley pole down, then no one can get hurt; after that the rail is to be cleaned with water or contact is to be made between wheel and rail by means of the switch iron.—*Am. Elec.*, August.

REFERENCES.

Test of Railway Power Plant.—CARPENTER and RYAN.—An account of an elaborate test of the power plant of the Buffalo Street R'y Co.—*Sibley Jour. of Eng.*; *St. R'y Jour.*, July 21, and Int. Ed., August.

Testing and Repairing.—A well illustrated article describing the testing and repairing methods of the North Jersey Street Railway Co.—*St. R'y Jour.*, Aug. 4, and Int. Ed., August.

Three-Phase Traction.—A communication of Brown, Boveri & Co., referring to the article of Reichel (Digest, June 30); they claim the priority for practical installations of three-phase railways for themselves. Also a reply of Reichel.—*Elek. Zeit.*, July 12.

Power Station Design.—DAWSON.—A reprint of the paper noticed in the Digest July 28.—*St. R'y Jour.*, July 28, and Int. Ed., August.

Electric Canal Traction in Belgium.—PIERARD.—Some illustrations, with brief description, of the installation of the Gerard system, noticed in the Digest Aug. 11.—*Revue de l'Elec.*, June 30.

Electric Brake.—KREBS.—An illustrated description of an electric brake for trailers of the General Electric Co. of Berlin. It is a simple electromagnetic device for operating a cheek-brake, so that the latter may be operated either mechanically or by the electromagnetic device. —*Elek. Zeit.*, July 19.

Tramway Exposition.—A very complete report of the exhibits at the International Tramways and Light Railways Exposition held recently in London, as noticed in the Digest July 21, 28.—*St. R'y Jour.*, Aug. 4, and Int. Ed., August.

Funeral Cars.—An illustrated description of special cars for funeral purposes run by Chicago, Cleveland and St. Louis tramway companies.—*St. R'y Jour.*, Aug. 4, and Int. Ed., August.

Tramway Profits.—GADSBY.—A reprint of the paper noticed in the Digest July 28.—*St. R'y Jour.*, July 28, and Int. Ed., August.

London.—An article giving information of the London County Council scheme of constructing 28¼ miles of new electric tramways in the metropolitan area.—Lond. *Elec. Rev.*, Aug. 3.

Central London Railway.—A continuation of the well illustrated article (Digest, July 21), in which the description of the power house is concluded.—Lond. *Elec.*, Aug. 3.

Norwich.—An illustrated description of the tramways of Norwich, now in course of erection, the trolley system being used.—Lond. *Elec. Rev.*, July 27, Aug. 3.

Hungary.—MAURER.—A statistical article on the electric tramways in Hungary in 1898. Also an article giving the track lengths of the electric railways of Hungary at the end of 1899.—*Zeit. fuer Elek.*, June 10.

Glasgow.—YOUNG.—A long abstract of the paper on the Glasgow tramway system, noticed in the Digest July 28.—*St. R'y Jour.*, Int. Ed., August.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

REFERENCES.

Municipal and Private Plants.—A long article discussing a report of the U. S. Dept. of Labor on municipal and private ownership of water, gas and electric light plants in the U. S. In the report detailed facts and figures are given regarding 632 private and 320 municipal electric lighting plants, but it seems that no general conclusions have been drawn. The present article discusses the question of municipal and private water works.—*Eng. News*, Aug. 9.

Reduction of the Light Load Losses in Alternating Current Supply. —An editorial discussion of the paper of Boot, abstracted in the Digest July 28.—Lond. *Elec.*, Aug. 3.

Automatic Replacing Fuse.—A reprint of the English article on the Hemingway-Coley fuse, abstracted in the Digest Aug. 11.—*El'ty*, Aug. 8.

Milan.—MERIZZI.—A communication referring to the description by Kolben of the high-tension three-phase current plant at Prague, Austria, furnishing electrical energy at the same time for traction, power purposes and private and public lighting from the same set of machines and the same brushes. He denies that this is the first example of such a plant. The plant of the General Edison Co. of Milan has the same characteristic features, while the voltage is higher, 13,500 volts, the transmission line has a greater length and the capacity of the plant is greater.—*Elek. Zeit.*, July 12.

Buenos Ayres.—An illustrated reprint of the English article, noticed in the Digest Aug. 4.—*Elec. Rev.*, Aug. 8.

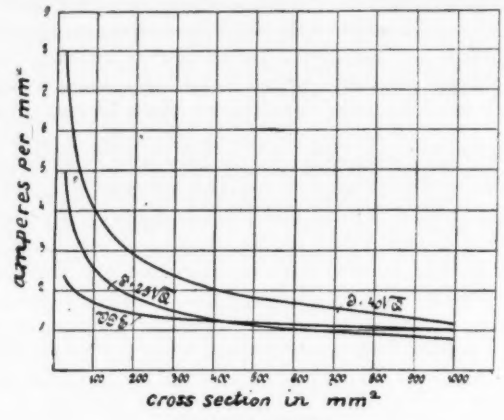
Zwickau.—An abstract of the annual report for 1899 of the direct current lighting and traction plant of Zwickau, Germany.—*Elek. Zeit.*, July 12.

Guernsey.—A description of the recently opened lighting plant of the Edmundson Elec. Supply Co. at Guernsey; the low-pressure three-wire system of distribution is used, with a pressure of 210 volts at the consumer's lamps.—Lond. *Elec. Eng.*, Aug. 3.

Rothesay.—An illustrated description of the electric lighting plant at Rothesay; the direct-current three-wire system is used with 500 volts between the outers.—Lond. *Elec. Eng.*, Aug. 3.

WIRES, WIRING AND CONDUITS.

Heating of Underground Conductors.—APT.—An article calling attention to the importance of an investigation of the safe carrying capacity of underground cables, especially for cable lines of shorter length. The conditions are different from those of conductors in air; while a conductor in air may be regarded as a cylinder in an infinite medium, an underground cable behaves like a cylinder, surrounded by a concentric zone of earth of a certain thickness (which Wilkens calls the "active heating zone," Digest, June 23). He develops the formulas for both cases. In the case of a conductor in air, he arrives at Kennelly's well-known formula which says that the safety limit of current is equal to the 1.5th power of the diameter of the conductor multiplied with a constant depending upon the material used for the conductor, and upon the increase of temperature which is allowed as a safety limit. In the case of an underground cable, he arrives at a formula stating that the safety limit of current is equal to a constant multiplied with the square root of the conducting copper cross-section of the cable; the constant depends here upon the increase of temperature which is allowed as a safety limit, upon the material of the conductor, upon the properties of the earth and the depth of the cable below the earth surface. He describes a series of experiments with an underground copper cable, and shows that the results can be well represented by his formula and that the constant ratio of the safety limit of the current (in amperes) and the square root of the conducting copper cross-section of the cable (in square millimetres) is for the conditions of his experiments equal to the degrees of allowed increase of temperature (in centigrades) plus 15, or, in other words, if the original temperature of the cable is assumed at 15 degs. Celsius, the constant is equal to the highest temperature (in degrees of Celsium) which is allowed as a safety limit for the cable. From this it is easy to find also a relation between the safety limit of current density (in amperes per square millimetre) and the conducting cross-section (in square millimetres). From this relation the accompanying diagram is calculated; in which I means the current, Q the cross-section. Two curves are calculated; for one the safety limit of the temperature of the cable is assumed at 40 degs. Celsius, for the other at 25 degs.; that is, as 15 degs. is the original temperature, for the first an increase of temperature of 25 degs., for the other by 10 degs. is allowed. For comparison, the curve $V\ D\ E$ is added, which is calculated from Kennelly's formula for air conductors, the safety limit of temperature being assumed at 25 degs. He says, however, that the correctness of his formula and diagram has not yet been generally proved, as his experiment can be regarded only as preliminary.—*Elek. Zeit.*, July 26.



HEATING CURVES.

ELECTRO-PHYSICS AND MAGNETISM.

Metallic Conduction.—REINGANUM.—A contribution to the kinetic theory of metallic conduction, based upon the theory of electrons. The ratios of the conductivities of a metal for heat and for electricity may be determined from the electro-chemical equivalent and the velocity of hydrogen atoms in a gas. He gets a very close agreement between calculated and measured values for aluminum, and concludes that in metals also, as in liquids, electricity moves in separate quantities of the value of the quantities transported by electrolytic ions, and that the principles of the kinetic theory of gases apply to both.—*Ann der Physik*, No. 6; abstracted in Lond. *Elec.*, Aug. 3.

Peculiar Phenomenon in Passing a Current Through a Vacuum Tube.—RIGHI.—A description of the following experiment. A circuit contains a small storage battery, a tube with rarefied gas, with electrodes of different forms (for instance, a disk and point), a galvanometer and a water resistance. The tube may be illuminated under certain conditions; then by simply changing the place where the

water resistance is inserted in the circuit the luminosity of the tube and the current passing through it are changed.—*Il Nuovo Cim.*, August, '99; abstracted in *L'Eclairage Elec.*, June 9.

Electric Absorption.—POTTS.—An illustrated account of a long investigation which has as its object the testing of methods devised by Rowland (Digest, July 22, 1899) for the measurement of electric absorption, for the measurement of the energy losses due to hysteresis and eddy currents, and for the detection of short circuits in coils. The methods were found perfectly practical. He found that a condenser possessing electric absorption may be considered as a capacity in series with a resistance, both of which depend upon the period of the current. While the variation is in the proper direction in each case, its rate of change with the period does not agree with Rowland's theoretical formula, especially in the case of wax and paper condensers.—*Am. Jopr. of Sc.*, August.

Earth's Magnetism.—SUTHERLAND.—A long abstract of a paper read before the Australasian Ass'n for the Adv. of Sc. A possible cause of the earth's magnetism is the rotation of an electrostatic field within the earth. He treats analytically the case of a sphere revolving around a central axis and charged with electricity of a given surface density; he shows that the formula of the magnetic field in this case has exactly the same form as that of the potential for a uniformly magnetized sphere, or for a sphere with an infinitely short magnet of finite moment at its centre. To account for the magnetic field of the earth, the electrostatic surface density has to be 51,000 electrostatic units; such a charge would produce an enormously strong electrostatic field at the surface of the earth, for which there is no evidence. But if we imagine the equal and opposite electric charge gathered at the centre, it would completely neutralize the electrostatic field due to the surface charge, while by being at the centre it would fail to affect the magnetic field of the surface charge. This gives an ideal model of the earth's magnetic field as produced by the rotation of a powerful internal electrostatic field; the magnetic field outside the earth would be the only external evidence of the existence of the electrostatic field within. Calling the field got by averaging round circles of latitude the primary, and the residual field which causes the want of coincidence between magnetic and rotational axes the secondary, our possible cause for the primary is such as will prevent the primary field from sharing in the earth's rotation. Thus the substance of the earth revolves through a magnetic field which is as fixed as if derived from fixed external magnets. The earth with magnetic material in it and with a conducting crust is somewhat like a dynamo armature revolving in the field of the exciting magnets. The magnetic material intensifies the primary field of the last section by magnetic induction, and if the permeability is unsymmetrical the induced field may not lie in the same direction as the inducing. The actual obliquity of the magnetic to the rotational axis is therefore traced to unsymmetrical magnetic permeability of the earth, which also causes the induction of the earth currents, the secular variation of whose tracks is the cause of the magnetic secular variation. The theory advanced by the author to account for daily variation is that under the action of the sun's rays the oxygen and ozone of the atmosphere become the active substance of a large secondary battery whose alternate charge and discharge are the cause of the daily variations. In a note in the same issue Gilbert calls attention to two considerations which seem to him to be fatal to Sutherland's theory. First, the theory calls for a strong electric field which does not rotate with the earth; he does not see how such a field could arise or exist. Second, the theory requires that the earth be made of insulating material many times nearer perfection than the air itself; this seems very improbable.—*Terr. Magnetism*, June.

REFERENCES.

Choking Coil.—An illustrated article giving the design of a choking coil for use in series with one, two or three open arcs on a constant potential circuit of 100 or 110 volts; its dimensions and windings are based upon a magnetic density of 30,000 lines of force per square inch in the core, and it may be adjusted to pass any current from one-half to 15 amperes. The apparatus is of the adjustable core type, and, if desired, the winding can be tapped at various points and the coil can be used as an auto-transformer.—*Am. Elec.*, August.

Arcs Between Metals.—ARONS.—A French abstract of the German paper noticed in the Digest June 2.—*L'Eclairage Elec.*, June 9.

Alternating Current Sparking.—KALLIR.—A longer illustrated abstract of the paper noticed in the Digest July 21.—*Elek. Zeit.*, July 26.

Energy Absorbed by Condensers.—PELLAT and BEAULARD.—A French Academy note referring to the result obtained by Beaulard that there is no dielectric hysteresis, but only dielectric viscosity (Digest, June 30). They calculate in the present paper the energy absorbed by a condenser, the plates of which are submitted to a sinusoidal difference of potential and obtain a very simple formula.—*Comptes Rendus*, p. 1457; abstracted in *L'Eclairage Elec.*, June 9.

Moving Bodies in an Electric Field.—HEYDWEILLER.—A long illustrated French abstract of the German paper noticed in the Digest Dec. 30.—*L'Eclairage Elec.*, June 9.

Experiments.—DAILY.—An illustrated description of some apparatus for demonstrating the mechanical forces exhibited in an electrostatic field.—*Sc. Amer.* Aug. 11.

Thermoelectric Motor.—An illustrated description of a thermoelectric motor, devised by Mayer. Both the current necessary for the excitation of the field magnets and that for rotating the armature, is generated by thermoelectric couples in the machine itself, the heat being supplied to the hot junctions by gas flames.—*Elec. Rev.*, Aug. 8.

Thermoelectric Currents.—EGG-SIEBERG.—An account of experiments which appear to show that if the different points of a conductor are not equally heated, e. m. fs. are acting, their direction and intensity depending upon the nature of the conductor and upon the drops of temperature. He applies his results upon the theory of terrestrial magnetism.—*Elek. Zeit.*, July 26.

Discharge Spark.—RUHMER.—A description of the special conditions under which in a tube evacuated to a moderate degree, the discharge occurs in a regular screw line, which rotates at the same time around its axle.—*Phys. Zeit.*, June 23.

Radiation.—An illustrated description of some recent experiments, made by Mr. and Mrs. Curie, with the radiations of polonium and radium, which were noticed in the Digest.—*Sc. Amer.*, Aug. 11.

Vacuum Phenomena of Nitrogen.—LEWIS.—An account of an investigation of the fluorescence of the walls of a vacuum tube containing nitrogen. It is likely that very minute quantities of oxygen are the cause of the phenomena.—*Ann. der Physik*, No. 7; abstracted in Lond. *Elec.*, Aug. 3.

Oscillatory Discharges in Vacuum Tubes.—TELESCA.—An account of an experimental investigation of the energy consumed in oscillatory discharges of a condenser, consisting of several Leyden jars, through a vacuum tube.—*Il Nuovo Cimento*, December, '99; abstracted in *L'Eclairage Elec.*, June 9.

Rarefied Gases.—SCHMIDT.—A French abstract of his German paper on the influence of temperature on the potential fall in rarefied gases. (Digest, June 16).—*L'Eclairage Elec.*, June 9.

Roentgen Rays.—SCHENKEL.—The first part of an article giving a summary of several theories on the nature of Roentgen rays.—*Schweiz. Blaetter fuer Elek.*, July 22.

Roentgen Rays.—CAMPANILE and CIOMME.—An illustrated account of an experimental investigation of the discharge of a condenser caused by Roentgen rays.—*Phys. Zeit.*, June 23.

Zeeman Effect.—RIGHI.—A long mathematical paper on the general theory of the Zeeman effect.—*L'Eclairage Elec.*, June 9.

Terrestrial Magnetism.—The June issue contains the following articles: An illustrated description of the magnetic observatory at De Bilt, near Utrecht, by Snellen. An illustrated description of magnetic intensity variometers, by Eschenhagen. An article in German by Liznar, giving some remarks on the measurement of the horizontal intensity of terrestrial magnetism by means of the magnetic theodolite. A long abstract of a paper by Sutherland on a possible cause of the earth's magnetism and a theory of its variations (see abstract above). A biographical sketch, with portrait, of Dr. William Gilbert. An abstract of a paper on some recent contributions to terrestrial magnetism, by Bauer. Two communications, by Chree and Watson, on glass windows in magnetometers.—*Terr. Magnetism*, June.

Electric Furnaces for Producing Calcium Carbide.—FROELICH.—A long illustrated article, criticizing the paper of Carlson, abstracted in the Digest Mar. 17 and Apr. 7. He gives brief illustrated descriptions of some types of furnaces for continuous and for interrupted operation, and then criticizes some special statments made by Carlson in favor of interrupted operation. He says that the carbide taken from a furnace for continuous operation is not necessarily liquid, as Carlson thinks, but in the better types of furnaces for continuous operation the carbide is in solid form, so that the temperature may be held at a comparatively low point. Other things being equal, the tempera-

ture of the arc or of the carbide which is being formed is said to be considerably higher in a furnace for interrupted operation than in a furnace for continuous operation; in order to take out the carbide rfom a furnace designed for continuous operation, no higher temperature is required than for interrupted operation. The difference of the limits between which the temperature of the carbide that is being formed varies is greater in furnaces for interrupted operation than in furnaces for continuous operation. Carlson had pointed out that in a furnace for interrupted operation the carbide cools in the furnace and the heat given out from the fluid produces new carbide, without supply of electrical energy to the furnace; the present author shows that this kind of formation of calcium carbide is not so considerable as Carlson thinks, and that it takes place just as well in the better types of furnaces designed for continuous operation. He says that these better types require less electrical energy for the production of calcium carbide than the furnaces designed for interrupted operation. He says that the latter furnaces have come in more general use, as their design was easy. The development of continuously operated furnaces required extended special studies; their main difficulty was a practical method of continuously taking out the carbide. To the production of calcium carbide the furnaces for intermittent operation are well adapted in spite of the great difference of temperatures between which they are working. But for other purposes the advantages of continuously operated furnaces are far more important, especially in the case of chemical reactions which require a small difference of temperature. The main advantage of continuously operated furnaces —namely the possibility of working without interruption for a long time with the same furnace—will become more and more valuable.—*Zeit. fuer Elektrochemie,* July 5.

Anodes for Electrolytic Alkali Processes.—WEIGHTMAN.—A summary of the many attempts made to find an anode of good electrical conductivity and which is not attacked by the products of electrolysis. The chief cause of the disintegration of carbon anodes is not due to the chlorine evolved, but to the oxygen, and to reduce the wear of the carbon the essential point is to keep down the evolution of oxygen at the anode. This may be produced from several causes, namely, the presence of caustic soda, sodium hypochlorite, sodium chlorate and perchlorate, all the oxy-chlor acids and sulphuric acid and sulphates which are occasionally present as impurities. The current density plays also an important part in the life of carbon anodes, the wear being considerably greater at high current densities than at low; therefore as large a surface should be used as convenient. Since the laws governing the deterioration of carbon anodes are so little understood, it becomes extremely difficult to foretell their suitability from their chemical analyses or physical properties, and it is therefore advisable to put them to a direct test under conditions as close as possible to those under which they will be placed in practice; he gives rules how to make such tests. The great objection to the use of platinum is its high initial cost, but it has the great advantage of being almost entirely unattacked by either chlorine or oxygen, and entirely so when alloyed with about 10 per cent of iridium. He describes several attempts which have been made to economize the metal and so reduce its high initial cost. The article gives information about quite a number of patents.—*Eng. and Min. Jour.,* Aug. 4.

Oxidation and Reduction Cells.—LUTHER.—An abstract of a paper read before the Electrochemical Society of Frankfort. He starts from the fact that only "spontaneous" processes can be utilized for constructing a galvanic cell, and that therefore the e. m. f. of a cell supplying current must decrease and cannot increase. He considers the Daniell cell, and develops the general rule that the e. m. f. of a cell, in which a certain reaction occurs, is the greater the more concentrated are the materials which disappear and the more dilute the materials which are formed. He then asks the question: Which spontaneous processes can be used for building a cell? As electric conduction occurs without convection of material in metals, and with convection of material in electrolysis, at the electrodes necessarily oxidation or reduction processes must occur. Therefore for a galvanic cell oxidation and reduction processes must be utilized. He gave a brief sketch of the theory of electrolytic dissociation, and emphasized that the assumption of free charged ions is only a very convenient illustration for representing certain facts, but that it would be wrong to draw too far-reaching deductions from this illustration; "even the usual plural form, hydrogen ions, chlorine ions, contains more than corresponds to the actual facts." He considers some special cases of cells in which the electrodes do not participate in the oxidation and reduction processes.—*Zeit. fuer Elektrochemie,* July 5.

REFERENCES.

Electrolytic Operation of Mines.—LADD.—A communication, illustrated by a diagram, and referring to the great number of mines which have been worked to a considerable extent, but have ceased to be profitable under existing conditions. He suggests to convert such a mine "into a huge electrolytic cell with anode and cathode districts," so that "there will take place a movement of the metal values from the deposits *in situ* towards the cathode centres and the formation of rich ore deposits in and about such points."—*Eng. and Min. Jour.,* Aug. 11.

Storage Battery Ignition Outfit.—DOLNAR.—A longer illustrated article on the apparatus, described in the ELEC. WORLD AND ENG. Aug. 4, page 192.—*Am. Mach.,* Aug. 9.

Electrolytic Production of Soda and Chlorine.—HOBART.—The fifth article of his illustrated serial (Digest, July 28), describing a single fluid electrolytic cell without diaphragm, also a double fluid and a triple fluid cell.—*Am. Elec.,* August.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Work of the German Reichsanstalt.—A summary of the work done by the Reichsanstalt from February, 1899, to February, 1900. The comparison of the two sets of standard resistance coils showed good agreement; the variations during seven years amount only to a few hundred-thousandths of the original value. Preliminary experiments were made for determining the capacity of an air condenser. A greater number of zinc and cadmium standard cells were made for testing purposes; renewed measurements gave results in good agreement with the figures published last year (Digest, Sept. 23, 1899). The exact investigation of the conductivity of aqueous solutions has been concluded for the chlorides and nitrates of alkaline metals. The instruments, storage batteries, primary cells, cut-outs, insulating and conducting materials, arc lamp carbons, fuses, which have been tested, are given in a table. Statistical material on the use of electric meters in practice has been collected; according to the information given by the central stations, about 60,000 meters are at present in use in Germany, while about twice as many is the number estimated by the manufacturers. The apparatus for testing alternating current instruments was completed. A new resistance material of Heraeus was tested, the investigation of the resistances devised by Kundt was continued. One hundred and eleven Clark and 22 Weston cells were tested. The variation from the normal e. m. f. was below 0.0003 volt for 83 Clark cells, between 0.0004 and 0.0006 volt for 23 cells, 0.001 volt for 1 cell and greater than 0.001 volt for 4 cells. The agreement of the commercial Weston cells was found to be very satisfactory. The magnetic properties of 25 samples of steel and iron were tested. An investigation was made of the difference between continuous and interrupted magnetization (see Digest, Apr. 14). Also preliminary measurements were made to investigate the influence of repeated annealing upon the magnetic properties of different samples of iron.—*Zeit. fuer Instrumentenkunde,* May, June; abstracted in *Elek. Zeit.,* July 19, 26.

REFERENCES.

Photometry of Arc Lamps.—CARTER.—Continuation and conclusion of his article (Digest, Aug. 4, 11). He describes a commercial form of his photometer. The fairest way of stating the power of an ordinary commercial arc lamp is by giving the mean hemispherical candle-power over the lower hemisphere when the lamp is to be used for public lighting, and by giving the mean spherical candle-power when it is for shop or indoor lighting. He then describes arrangements for very quick and easy tests by which he can find the shape of the polar curve; the absolute candle-power in the horizontal direction is found by a separate measurement.—Lond. *Elec. Rev.,* July 27, Aug. 3.

Measuring the Intensity of Light.—ULBRICHT.—An illustrated article describing a method of determining the average intensity of light in a space by only one measurement. The method is based upon the supposition that a surface which gives diffuse reflection, for instance, a surface covered with a layer of chalk, if their different parts are uniformly illuminated, behaves like an incandescent surface regarding the light given out.—*Elek. Zeit.,* July 19.

Standard Cells.—HENDERSON.—An article giving descriptions and illustrations of the standard Daniell cell, the Clark cell, the British Board of Trade Clark cell, the Carhart-Clark cell and Callendar's Crystal Clark cell. He discusses the defects of Clark cells, gives formulas for the temperature coefficient, discusses the time or diffusion lag, and describes the behavior of a Clark cell when supplying current.

The article is concluded by a description of cadmium cells.—Lond. *Elec. Eng.*, July 27, Aug. 3.

Elasticity of Wires and Thin Rods.—Some editorial notes on the relative merits of a method of Wilberforce for determining Young's modulus from the observed longitudinal and angular vibrations of a load hung at the end of a helical spring composed of the metal to be tested, and of a similar method of Searle, in which instead of a helix, a long straight sample of the metal is tested, the upper end being rigidly clamped and the lower end loaded.—Lond. *Elec.*, July 27.

Potentiometer.—HABER.—An illustrated description of a potentiometer, devised by Luggin, for polarization measurements.—*Zeit. fuer Elektrochemie*, July 5.

Galvanometers.—DU BOIS and RUBENS.—An illustrated description of different types of armored galvanometers.—*Ann. der Physik*, v. 2, p. 84; abstracted, with illustrations, in *Elek. Zeit.*, July 12.

TELEGRAPHY TELEPHONY AND SIGNALS.

Wireless Telegraphy.—MARCHANT.—A communication on experiments with Marconi's system. In a certain case he got no good results, which he thinks was due to the screening action of a number of lime trees which closely surrounded the house to which the receiving pole was fixed; the trees, which are planted in a row approximately perpendicular to the line of transmission, would form a screen similar to the wire grids used in polarization experiments. He thinks that the greater distance to which signaling can be carried over sea than over land with a given height of mast is due partly to the complete absence of obstacles, but chiefly to the excellence of the earth connection which can be made direct to the sea water at both ends. He describes also some observations made on the spark at the sending station with a revolving mirror.—Lond. *Elec.*, Aug. 3.

Preece System.—Experiments are to be made with the improved Preece system of wireless telegraphy across the Bristol Channel, a distance of about 25 miles. This year the British navy has abandoned Marconi's system, which was successfully worked by the inventor last year between two battleships 65 miles apart; some ships have been equipped with apparatus designed by Jackson, which is similar in some respects to that of Marconi; but so far this system has not been worked a greater distance than 25 miles, and then the operation was somewhat imperfect.—Lond. *Elec. Eng.*, Aug. 3.

Mast Wires in Space Telegraphy.—LINDEMANN.—An account of a systematic investigation of the influence of the mast wire upon the intensity and the wave length of the system of waves emitted by a Righi oscillator. He used a horizontal arrangement for the latter, so that auxiliary wires could be attached on both sides. Such an oscillator emits two superimposed wave trains, one of which has the same wave length as that emitted by the oscillator without the wires, while the other has a greater wave length. The effect of the wires upon the original wave train of the oscillator is to strengthen it. When one of the "feelers" was put to earth and the other left in position, thus approximating to the arrangement used by Marconi, the second wave system could no longer be proved to exist; at least, its wave length could no longed be determined; otherwise the phenomena were the same.—*Ann. der Physik*, No. 6; abstracted in Lond. *Elec.*, Aug. 3.

REFERENCES.

Telephone.—MONTILLOT.—An illustrated description of Milde's system of telephone transmitters and receivers.—*L'Elec.*, July 14.

Telephonograph.—POULSEN.—A reprint of the French Academy note on his instrument.—*L'Ind. Elec., L'Elec.*, July 14.

Berlin.—LINDOW.—A long, well illustrated description of a new telephone exchange in Berlin.—*Elek. Zeit.*, July 26.

High Speed Telegraph.—A brief description of the Murray high speed page-printing telegraph.—*Sc. Amer.*, Aug. 11.

Type-Printing Telegraph.—A well illustrated description of a new type-printing telegraph, devised by Kuebler.—*Elek. Zeit.* July 19.

Wireless Telegraphy.—PRASCH.—The first part of an illustrated historical article on predecessors of Marconi.—*Zeit. fuer Elek.*, July 22.

Protection of Telegraph and Telephone Lines.—A summary of the measures which the German governmental office of telegraphy and telephony believes to be necessary for protecting telegraph and telephone lines against influences from electric installations, except electric railways.—*Elek. Zeit.*, July 19.

Interior Telephone Systems.—HENRY.—The fourth article of his serial (Digest, July 28), dealing with intercommunicating systems.—*Am. Elec.*, August.

Telephony.—Statistical tables, with additional notes, giving a great deal of information on telephony in 1898 in numerous countries of the earth; the United States is not included.—*Jour. Teleg.*, July 25.

Dutch East Indies.—The first part of a statistical article on telegraphy in the Dutch East Indies in 1897 and 1898.—*Jour. Teleg.*, July 25.

Japan.—An article, illustrated by diagrams, showing the development of telegraphy in Japan.—*Elek. Zeit.*, July 19. An article on telephony in Japan in *Elek. Zeit.*, July 26.

Russia.—A note on telephony in Russia. The lines of the Bell Telephone Co. in St. Petersburg, Moscow, Warsaw, Odessa and Riga will become the property of the Government in November, 1901; they will, however, then be rented to private companies.—*Elek. Zeit*, July 19.

MISCELLANEOUS.

Lightning Rods.—A full account of the long discussion which was held in the Electrotechnical Society of Berlin on the general rules proposed by the special committee (abstracted in the Digest, June 23). The principal speakers in favor of these rules were Strecker and Weber. Other speakers had objections against special statements contained in the book of Findeisen, which had been recommended in the report of the committee; Voller denied, for instance, that gutters make good lightning rods. The discussion was adjourned, the rules having not yet been adopted.—*Elek. Zeit.*, July 12.

Electric Effects of Light Upon Green Leaves.—WALLER.—A paper discussing the phenomenon that under certain favorable conditions green leaves show a true electrical response to light, consisting in the establishment of a potential difference between the illuminated and the non-illuminated half of a leaf which may amount to 0.02 volts. This effect shows a remarkable similarity with the effect of electric excitation upon nerve and muscle.—*Commun. to Royal Soc.*, June 14; abstracted in Lond. *Elec.*, Aug. 3.

Electric Cure for Tuberculosis.—A note on different electric methods which have been tried for curing tuberculosis. The Bleyer treatment consisted in placing a pad on the patient's chest directly over the diseased portion of the lung and a pad over the corresponding point on the back, and sending "a current of electricity at extremely high voltage" through the body for 20 to 30 minutes, this operation to be frequently repeated. In the Crotte method a powerful antiseptic is forced through the lungs by means of static electricity. The Carroll method uses "a Tesla oscillator, and by passing currents of high frequency and high voltage through the lungs of a patient, in time causes the tubercular matter to be eliminated from the system by the emunctories"; very good results are claimed for this method by the inventor. —*El'ty*, Aug. 8.

REFERENCES.

Pacific Coast Elec. Transmission Ass'n.—A long and full account of the proceedings at the Talmapais meeting. The papers read are abstracted in others columns of the Digest.—*Jour. of Elec.*, July.

..China.—BERESFORD.—An illustrated article on openings for mechanical engineers in China. The immediate development of China will probably proceed most rapidly in railways and electrical engineering. Telegraphs already exist all over China and are the property of the Government, but they are badly managed. Telephones exist in some of the settlements.—*Cassier's Mag.*, August.

Gutta Percha.—An article pointing out that if the future supply of gutta percha is to be assured in sufficient quantity, every effort should be made to prevent the wasteful cutting down of the trees. This is of great importance for the transatlantic cable schemes. The matter of rubber versus gutta percha for deep-sea insulation has lately given rise to some exchanges of opinion between America and Europe, America championing the cause of the former, while England and Germany have spoken in favor of the latter.—*Eng'ing, Elec. Rev.*, Aug. 1.

Kiel.—In a continuation of the account of the proceedings at the recent annual meeting of the Union of German Electrical Engineers at Kiel a description of the electrical plant of the Government dockyard is given; direct current is now used throughout, but a new plant for generating 1000-volt polyphase currents has been erected. The tramways of Kiel are briefly described and an abstract of a paper of Goldschmidt is given on his method of obtaining high temperatures with the aid of aluminum and the application for rail-welding, which process was already noticed several times in the Digest.—Lond. *Elec. Eng.*, July 27.

Electric Shocks.—An article on experiments made by Weber to ascertain under which conditions electric current is dangerous to life. He is said to have reached the conclusion that "there is danger in grasping the conductors of two alternate currents with the hands while in a dry condition whenever the difference between the intensity of the two conductors exceeds 100 volts."—*El'ty*, Aug. 8.

Insulating Gloves.—A note stating that a prize of $200 is being offered by a French society for the most efficacious insulating gloves for electrical workmen.—Lond. *Elec.*, Aug. 3.

Paris Exposition.—A well illustrated description of engines and generators at the Exposition.—*Am. Elec.*, August.

A long, well illustrated description of some prominent engines at the Exposition.—*Power*, August.

MANN.—An illustrated article on the generating plant.—*Sc. Amer.*, Aug. 4.

BLONDIN.—An illustrated article on the power houses of the Champ de Mars; also an illustrated description of the electric tramway of the Bois de Vincennes; also an illustrated description of the accumulators of Commelin and Viau, which are characterized by the use of a solution of a metallic salt (generally sulphate of cadmium), and by the fact that during the discharge the gas (generally oxygen) is utilized which has been developed during the charge at the anode.—*L'Eclairage Elec.*, June 23.

GUILBERT.—A well illustrated description of a Farcot two-phase alternator provided with the amortisseur of Hutin and Leblanc (Digest, Dec. 16, Thompson's paper).—*L'Ind. Elec.*, July 10.

BOUCHEROT.—An illustrated description of a Breguet three-phase alternator of the system devised by Boucherot, the e. m. f. at the terminals being maintained constant by means of a special exciter and a "compounding transformer."—*L'Ind. Elec.*, July 25.

PERKINS.—An illustrated article on exhibits of the Internat. Elec. Co. of Liege, Belgium.—*El'ty*, Aug. 8.

A continuation of the illustrated serial describing exhibits of Mather & Platt, Manchester, and of Kolben & Co., Prague.—Lond. *Elec. Eng.*, July 27.

A long, illustrated description of a 750-kw two-phase alternator, with Leblanc's amortisseur, exhibited by Farcot.—*L'Elec.*, July 14.

BLONDIN.—An illustrated description of Rieder's apparatus for engraving by electrolysis (Digest, Jan. 13, May 12, June 16).—*L'Eclairage Elec.*, June 9.

An illustrated description of a gas-driven dynamo exhibited by Koerting & Co., Hanover.—*Elek. Zeit.*, July 26.

An illustrated description of the three-phase motors for driving weavers' looms, exhibited by the United Elec. Co., of Vienna.—*Zeit. fuer Elek.*, June 10.

New Books.

MAGNETIC INDUCTION IN IRON AND OTHER METALS. By J. A. Ewing. Third edition, 1900. 393 pages.

Mr. Ewing's work is well known and has established its reputation as a classic on magnetic phenomena. The third edition now issued fully maintains this reputation. It is in its general design the same as the previous edition, merely adding a review of the phenomena discovered and the investigations made since the issue of the last edition.

The first chapters of the work contain a general discussion of magnetism and the methods of magnetic testing. Then follow chapters on magnetic induction, hysteresis, magnetization in weak fields and in strong fields. Then the effects of temperature and of stress are discussed. The last chapters contain a discussion of the magnetic circuit, of the molecular theory of magnetism and on magnetic testing.

The most interesting chapter is that on molecular theory. Treating as usual the molecules as magnets, Mr. Ewing shows by reasoning and by experiments on models that the double bend curve of magnetism and the loop of hysteresis follow from the interaction of the molecular magnets. The molecular magnets are arranged in irregular groups. By the application of a magnetizing force they are slowly deflected until a position of unstable equilibrium is reached, the group breaks up, and the molecules swing over a large arc into a new position of equilibrium in closer alignment with the m. m. f. But while this theory explains the permeability curve and the loop of hysteresis, it does not explain loss of energy during the cycle of magnetization.

In a model of small magnets when a group is broken up by the increase of m. m. f. the magnets oscillate around some new position of equilibrium, until they gradually come to rest by the dissipation of their energy of oscillation by air friction, etc. But for the molecules and their motions no friction exists, and thus it can not be seen how the energy represented by the hysteretic loop, which by Mr. Ewing's theory is transmitted as mechanical oscillation to the molecules in the moment of the breaking up of the group, is dissipated. In other words, Mr. Ewing's theory as regards dissipation of energy by the cycle of magnetization leaves our knowledge where it was before, without offering an explanation of the mechanism of the energy dissipation.

There is, indeed, in the whole work of Mr. Ewing nowhere a distinction made between hysteresis and dissipation of energy by molecular friction, but, on the contrary, when discussing the elimination of hysteresis by vibration, etc., the reader is left to assume that hereby the dissipation of energy is eliminated. This, however, does not agree with experience; on the contrary, the energy loss during the magnetic cycle seems to be constant and independent of the existence or the collapse of the hysteretic loop, and the hysteretic loop is merely one way in which the energy dissipated by molecular friction is supplied to the magnetic circuit.

This phenomenon is probably nothing but a case of the general law of nature, whereby no transformation of energy is entirely reversible, but in any cycle of energy transformation a part of the energy is transformed into heat.

HANDBUCH DER ELEKTRISCHEN BELEUCHTUNG. By Jos. Herzog and C. P. Feldmann. Berlin: J. Springer. 521 pages, 428 illustrations. Price, 16.00 marks.

Mr. Herzog is the chief engineer of Ganz & Co. in Budapest. Mr. Feldmann is the chief electrician of the Helios Company, of Cologne; both are well-known authors of textbooks and contributors to the electrical press. As they say in the preface, their book is based upon a practice of fifteen years in electric lighting. It contains, indeed, a very great deal of valuable and useful information; it is only to be regretted that for a reference book the index is rather poor, and the arrangement of the whole is not such that the reader is always enabled to find quickly what he wants.

The first chapter deals with the sources of electric light, the phenomena of lighting in incandescent and arc lamps, the photometric units, the distribution of light and special features of the construction, connection and operation of incandescent and arc lamps. At the end of this chapter the authors give in two tables an estimate of the number of candles necessary to light special rooms in private houses, offices, stores and hotels; for arc light the number of candles is given per square meter of the floor; for incandescent lamps per cubic metre of the room; the latter method takes account of the reflection from the ceiling and the walls. The second chapter deals with the construction of the line, aerial lines, interior wiring and underground wiring being discussed. The first half of the third chapter deals with the distribution of currents in networks of circuits containing resistance, reactance and capacity. Series systems, parallel systems and mixed systems are discussed, and the different systems are compared as to the amount of copper required, first on the basis of equal minimum voltage in the lighting circuits, second on the basis of equal maximum voltage in the transmission line. The second half of the same chapter deals with the working in parallel of direct-current dynamos, with the connection in parallel of alternators, the use of storage batteries, the use of transformers, the connection in series of dynamos and the method of supplying a three-wire system from a single dynamo. The fourth chapter deals with the different systems of regulation, the fifth with fuses, lightning arresters, cut-outs, measuring instruments, meters and other accessories; the sixth with the insulation of the line, the seventh with lamp-holders, the eighth with the design of central stations, while in the ninth and last chapter six typical central stations are described. The descriptions and explanations are clear and simple. The typography and illustrations are excellent.

Directory of Electrical Societies, Etc.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Next meeting, New York, Sept. 25, 26 and 27, 1900.

AMERICAN STREET RAILWAY ASSOCIATION. Next meeting, Kansas City, Mo., Oct., 16, 17, 18 and 19, 1900.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Next meeting, Saratoga, N. Y., Sept. 4, 1900.

CANADIAN ELECTRICAL ASSOCIATION. Next meeting, Kingston, Ont., Aug. 29-31, 1900.

NATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Next meeting, Pittsburg, Pa., Sept., 25, 26 and 27, 1900.

OLD-TIME TELEGRAPHERS' ASSOCIATION AND THE U. S. MILITARY TELEGRAPH CORPS. Next meeting, Minneapolis, Minn., Sept. 18, 1900.

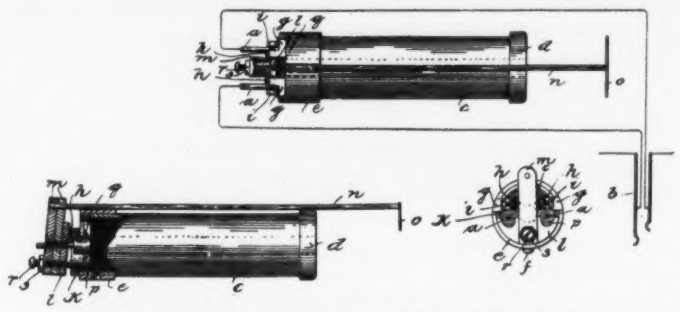
STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Next meeting, Buffalo, Sept. 18 and 19.

THE ROENTGEN SOCIETY OF THE UNITED STATES. Next meeting, New York City, Dec. 13 and 14, 1900.

Improvements in Telephone Apparatus.

Mr. W. W. Davis has assigned to the Stromberg-Carlson Telephone Company, of Chicago, a recent patent on an improved target telephone annunciator, in which the device may be operated with a minimum of current owing to the small air-gap and in which the armature pivots can be readily secured in position without having to be separately fastened in place.

The annunciator shown is provided with a single electromagnet



FIGS. 1, 2 AND 3.—TELEPHONE TARGET ANNUNCIATOR.

whose terminals are led through tubes *a a* to permit the annunicator to be connected with a suitable circuit—such as is illustrated, for example, in Fig. 1, where the terminals of the annunciator coil are connected with the back contacts of a spring-jack switch *b*, connected with the telephone line to enable a subscriber to include the annunciator in circuit with a suitable source of current.

The annunicator coil is provided with a magnetic sheath *c*, having a cap *d* at one end. A collar *e* incloses a sheath at the other end, being secured thereto by a screw *f*. This collar is provided with two rearwardly and inwardly extending ears *g g*, which are located slightly above the diameter of the coil. Each ear is provided with an inner rearward extension *h*. The extensions *h* are provided with threaded holes extending transversely of the annunciator for receiving the pivot screws *i*, the pivot screws being opposed and located slightly above the diameter of the sleeve *e*. The extensions *h* are preferably slotted, as indicated. The lower half portion of the sheath or sleeve *c* projects slightly to the rear and forms a segmental pole-piece *k*. The armature *l* is similar in outer contour to the pole-piece *k* and is provided with curved recesses for accommodating the tubes *a a*. The armature proper is preferably pivoted directly upon the screws *i i*, this portion of the armature being reduced in width, the portion of the armature below the diameter of the coil being practically semi-circular. Mr. Davis believes it is new to make a pole of the electromagnet in the form of a segmental sleeve-section.

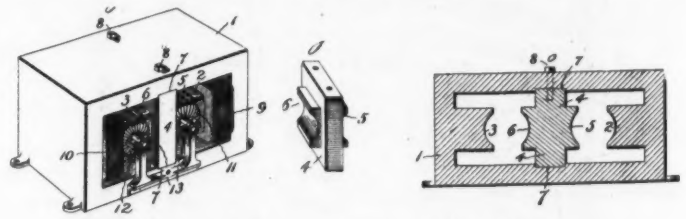
Strips of metal *m* are secured to the armature to act as a counterbalance and to serve as a means of securing one end of the target-lever *n* to the armature, the other end of the target-lever carrying a target *o*. A collar *p* of insulating material surrounds the core *q* of the electromagnet, the core projecting beyond the collar and forming a second pole-piece. An adjusting screw *r* passes through the armature and the counterbalancing plate secured thereto and is adapted for direct engagement with the insulating collar *p*. A set-nut *s* is employed to secure the screw in any position to which it may be adjusted. When the circuit is closed through the annunciator, the magnetic circuit is completed by way of the core *q*, the armature, and the projecting portion *k* of the sleeve.

A patent has been issued also to A. Stromberg and W. M. Davis, and assigned to the Stromberg-Carlson Telephone Company, on circuits and apparatus in central energy systems, whereby special clearing-out indicators may be dispensed with, one of the line-indicators being retained in connection with an established circuit between subscribers, and thereby performing the function of a clearing-out indicator. The invention in its preferred embodiment relates more particularly to multiple-switchboard telephone-exchange systems, and by its use they are enabled to prevent the false operation of the called-subscriber's line-indicator, that may be located at another section of the switchboard, the line-indicator of the calling subscriber being preferably the one that acts as a clearing-out indicator upon the establishment of a connection between subscribers. The invention also has for its object the provision of means whereby the coil or winding of the line-indicator that is used as the clearing-out indicator may be used as an impedance-winding to prevent the passage of voice-currents and at the same time permit of the flow of battery-current over the line. In order to maintain a balance of the system, they employ a second impedance-winding, which acts in the same capacity. Each telephone-line is thus provided with an annunciator or indicator having a winding which acts as an exciting-winding and also as an impedance-winding, and, in addition to this winding, a second winding which acts solely in the capacity of an impedance-winding. For the sake of convenience the two windings thus associated with each line are wound upon a common core, provision being made, however, to prevent that winding which acts solely as an impedance-winding from influencing the armature of the indicator. The centralized battery is not included directly in the cord-circuit, as this would necessitate in the best telephone practice the employment of repeating-coils. The limbs of the telephone lines are extended beyond their line-switches or spring-jacks to the common battery, from which the operator's telephone outfit is also supplied. The invention has for its further object the provision of improved means whereby the test-thimbles of connected lines may be charged. Another patent to the same inventors and assignors employs as the impedance-winding the winding of an indicator so as to secure a proper balance of the system to prevent leakage of voice-currents and to counteract the effects of induction. It relates also to auxiliary alarm circuits, commonly known as "night-bell" circuits, used when only a few operators are on duty at night, with the object of directing their attention to any call, etc. It consists in providing circuits and apparatus jointly controlled by an indicator acting as a clearing-out indicator, and by the connecting apparatus, preferably the connecting-plug, used to put subscribers in communication.

Twin Motor for Automobiles.

The public prints have recently made note of the automobile now being operated at Scranton, Pa., by Mr. P. J. Collins, of that city. This inventor has devised a form of "twin motor," which is particularly designed for the purpose of propelling and steering automobiles, in which the driving-wheels turn independently of each other. The motor is of light construction having a single field-casing with two parallel armatures therein which operate independently and whose shafts may be connected to the independent driving-wheels of the automobile, so that said wheels may be driven at the same speed to propel the vehicle in a straight line or at varying speeds for the purpose of turning corners.

In the accompanying drawings, Fig. 1 is a perspective view of the



FIGS. 1, 2 AND 3.—TWIN AUTOMOBILE MOTOR.

motor. Fig. 2 is a similar view of the partition which extends centrally through the motor-casing, dividing it into two compartments and also forming a part of the magnetic circuit for both armatures. Fig. 3 is a transverse section through the field of the motor shown.

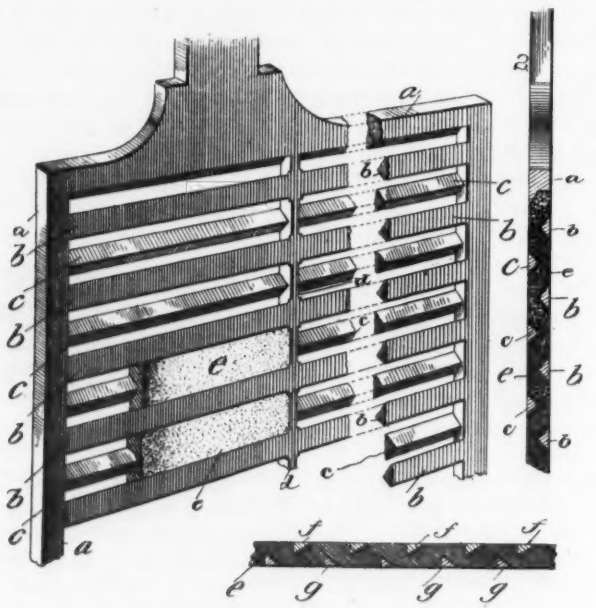
Referring to the drawings, Figs. 1, 2 and 3, 1 indicates a field-casing, which, as shown, consists of a hollow rectangular frame having inwardly projecting pole-pieces 2 and 3 at its opposite sides and a central partition 4, extending through the interior of the casing midway between the pole-pieces 2 and 3. The partition 4 is formed with pole-pieces 5 and 6, projecting from its opposite sides, said pole-pieces being arranged opposite the pole-pieces 2 and 3, respectively.

The casing 1 is formed with interior grooves or channels 7 at the top and bottom, and the partition 4 is made separate from the casing and adapted to fit within these grooves, being normally held in place by means of suitable bolts 8, passing through the casing. The pole-pieces 2 and 3 are longer than their opposing pole-pieces 5 and 6, and the field-coils 9 and 10 are wound on said pole-pieces 2 and 3, respectively. The armatures 11 and 12 are mounted in suitable bearings 13. When the coil 9 is energized a consequent pole will be set up in the pole-piece 5, and when the coil 10 is energized a consequent pole will be set up in the pole-piece 6 and the current in either of the coils may be varied in strength or reversed, causing a corresponding variation or reversal of the magnetic poles in one compartment without affecting the poles in the other compartment, and the armatures will, of course, act independently of each other. The partition 4 is made removable for the purpose of permitting the coils 9 and 10 to be easily inserted or removed. The magnetic circuit through each half of the field-casing is very short.

Plate for Automobile Batteries.

Mr. J. B. Conrad, of Chicago, has assigned to the Hewitt-Lindstrom Motor Company, whose automobile work has recently attracted considerable attention, a patent on storage battery plates, whose bars are not intersecting, so that the plate is different from those of the grid or grating type. The objects of the invention are to produce a novel skeleton plate or grid that will be of less weight and will contain more active material than the forms of plate hitherto used of like size and which shall also be of such construction that the active material shall be continuous from the top to the bottom of the plate and will be securely held by the bars of the plate, and, further, to so construct the plate that it will not be affected by heavy discharges, nor can it be short-circuited by reason of the bending of the bars, which is a great defect in skeleton battery plates or grids heretofore made.

Fig. 1 is a perspective view of the plate. Fig. 2 is a vertical section of the plate. Fig. 3 is a view similar to Fig. 2, showing a slight modification of the form of the transverse bars. The lead plates are cast with an exterior or frame portion *a*, the side members of which frame are connected by opposite series of transverse bars *b c*. These bars are triangular in cross-section and are arranged alternately, bars *b* being at one side or face of the plate and bars *c* at the opposite side or face thereof. The outer faces or bases of these bars *b c* are respectively flush with and form part of the opposite broad faces of the plate, while the apices of the bars *b c* face inwardly and extend to about the median plane of the plate. These bars *b c* are practically independent and extend unbrokenly from one side of the plate to the other; but in large plates the bars may be braced at intervals by vertical cross-pieces or partitions *d*, which are parallel with



FIGS. 1, 2 AND 3.—AUTOMOBILE BATTERY PLATE.

the sides of the plate and give rigidity thereto. The number of these cross-pieces would, of course, depend upon the size and contour of the plate. These partitions divide the active material in the plate into vertical strips or sections. The adjoining bars *b* are separated a short distance corresponding to a little more than the width of their bases or outer faces, and the bars *c* are similarly separated and are arranged alternately with intermediate bars *b* when viewed from the side of the plate.

It will be observed by reference to Fig. 2 that the space between the triangular bars *b c* forms a continuous, tortuous, zigzag passage from one end of the plate to the other, in which passage the active material *e* is packed. Thus there is a continuous mass of active material *e* extending from the bottom to the top of the plate, which will give a very ready discharge and from which a heavy discharge can be obtained without the danger of breaking the active material or short-circuiting the battery. If the bars *b* or *c* should bend under a heavy discharge, it will not affect the continuity of the mass of active material, nor will it necessarily cause any breakage of the active material.

Owing to the peculiar construction of the plate the active material is locked thereto, as it were, by dovetails opposite each opening in the surface of the plate, Fig. 2, in a most advantageous and secure manner. Practically with the construction of plate shown in Figs. 1 and 2 these plates can be made of the same dimensions as the ordinary plates, while weighing less than the latter. For instance, a plate 5 ins. x 8 ins. weighs 1½ ozs. less and will hold 3 ozs. or 4 ozs. more active material than the ordinary plates of like dimensions.

In Fig. 3 the relative arrangement and triangular shape of the bars *f* and *g* are substantially retained; but in this modification the inner and lower angle of the bars is the longest and the upper angle of the bars is the shortest, so that the bars are flat on top and the longest angle is on the under side. This construction is good, but not so good as that already described.

Flexible Steel Armored Conductor.

Of the accompanying illustrations, Fig. 1 shows an application of the Greenfield flexible steel armored conductors, recently brought out and introduced by the Sprague Electric Company, New York. Fig. 2 shows a section of flexible cord, with rosette and terminal bushings.

The steel armored conductors are easily installed, especially in finished buildings, for open construction and fished wiring on the loop system, in accordance with the requirements of the National Electrical Code. The insulation surrounding the conductors is of high grade, and the mechanical protection afforded by the steel armor is practically perfect.

The steel armored flexible cord for lamp pendants and portables is desirable for use under extraordinary conditions, such as are found in machine shops, theatres, mills, show windows, factories, engine and boiler rooms, etc. In such service, ordinary cord soon becomes useless, principally on account of the absence of mechanical protection. These flexible conductors are also of special advantage in marine wiring, where the service is peculiarly exacting and severe on conductors, by reason of the high temperatures, vibrations of the ship, etc. The many objections to open wiring in factories and mills are entirely eliminated, it is claimed, by the use of these flexible armored conductors. They can be firmly secured on the surfaces of the structure wired and can be "fished" from pockets cut at convenient points.

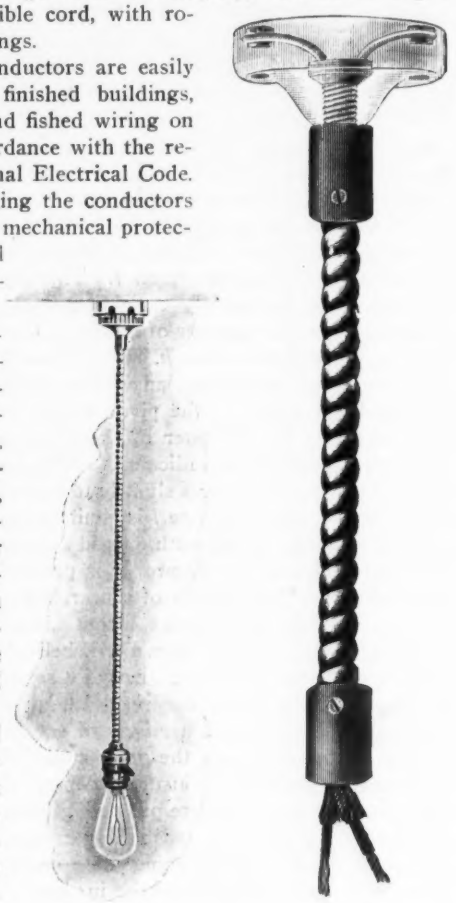


FIG. 1. FIG. 2.

The Sprague Company states that these flexible products have been fully approved by the Underwriters' National Electric Association.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET—During the past week the stock market was dull and inert, the only noteworthy movement being a drop of 2 points in Brooklyn Rapid Transit, followed by slight recovery. The week was replete with occurrences of extraordinary interest to Wall Street, but the stock market did not show any response to these influences. The remittances from this country on account of the British Exchequer Loan aggregated, for less than ten days, over $17,000,000. The only effect of these heavy transactions upon the local markets was a decline in rates for Sterling Exchange, caused by heavy sales of bills against the shipment of specie. Money on call closed at 1½ per cent. nominally. Time money was practically unchanged, and the demand was light. The rates are 3 per cent. for 60 days; 3½ per cent. for 90 days; 4 per cent. for four months, and 4@4½ per cent for five and six months. In the list of electric stocks some improvement in prices is noted, with the single exception of Brooklyn Rapid Transit, which, as already stated, dropped 2 points prior to the issuance of the annual report, this loss, however, being largely regained before the close of the week. General Electric advanced 4 points, and Metropolitan Street Railway, 2¼. Western Union also made a slight gain. Outside securities were somewhat improved in tone. There was a tendency towards higher prices, but quotations were well maintained; the general conditions seemed much more satisfactory than they had been. Some revival of speculative interest occurred and some issues, for a long time more or less neglected, became active, and, in a few cases, very strong. Trading was distributed throughout the list, the market being broader probably than it had been at any time for many weeks. Following are the quotations for last week, compared with those of the week previous:

NEW YORK.

	Aug. 11.	Aug. 18.		Aug. 11.	Aug. 18.
Gen. Elec.	132	136	Elec. Veh.	19	16½
Bklyn. Rap. Tran.	57¾	57¼	Elec. Veh., pfd.	40	40
Met. St. Ry.	152¾	154½	Gen. Car.	4¾	6⅜
Am. Tel. & C.	90	..	Ill. Elec. Veh. Tran.	1½	1⅜
West. Un. Tel.	79½	80⅛	N. Y. Elec. Veh. Tran	7½	8
Am. Dist. Tel.	25	..	New Eng. Elec. Tran.	4	3¾
Com. Cable.	160	160	Tel., Tel. & C. of Am.	6	6¼
Elec. Boat.	14	13	Hud. Riv. Tel.	116	117
Elec. Boat, pfd.	30	30	N. Y. & N. J. Tel.	160	..

BOSTON.

	Aug. 11.	Aug. 18.		Aug. 11.	Aug. 18.
New Eng. Tel.	123½	123½	Erie Tel.	96	96
Mex. Tel.	2 1-16	2	Gen. Elec., pfd.	138⅞	..
Westingh. Elec.	..	45½	Am. Tel. & Teleg.	142½	..
Westingh. Elec., pfd.	62½	63	Edison Elect. Lt.	205	..

PHILADELPHIA.

	Aug. 11.	Aug. 18.		Aug. 11.	Aug. 18.
Elec. Stor. Bat.	70	..	Phil. Elec.	2⅝	..
Elec. Stor. Bat., pfd.	90	..	Pa. Elec. Veh.	3½	..
Elec. Co. of Am.	..	..	Pa. Elec. Veh., pfd.	2	..
Gen. Elec. Auto.	..	..	Am. Rys.	32	..

CONSOLIDATION AT DULUTH.—The street railway systems of the cities of Duluth, Minn., and Superior, Wis., comprising about 73 miles of track, have been consolidated under the title of the Duluth-Superior Traction Company, incorporated under the laws of Connecticut, with a capital stock of $5,000,000, divided into $1,500,000 4 per cent. preferred stock, and $3,500,000 common stock. Both properties have been in the hands of receivers, but the receiverships have now been discharged. The property of the Superior Rapid Transit Company has been conveyed to the Duluth Street Railway Company, which company has authorized an issue of $2,500,000 first mortgage and collateral trust 5 per cent. 30-year bonds, of which amount $500,000 are to remain in the treasury for future improvements, etc. The holders of old first mortgage bonds upon each property will have the opportunity of even exchange for the new bonds, and the larger part of them have accepted the offer. The consolidated bonds upon the Duluth property were all deposited with Brown Bros. & Co., under an agreement to receive in exchange therefor 110 per cent. in new preferred stock and 90 per cent in new common stock. The Central Trust Company of New York is trustee under the mortgage securing the new bonds and also registrar of the stock. The Farmers' Loan and Trust Company of New York is transfer agent for the stock.

MANHATTAN—Some of the large traders have been buying Manhattan on figures showing the saving expected to be brought about by the use of electric equipment. These figures indicate theoretically that Manhattan can be operated for 45 per cent. of the gross earnings. It is claimed that the conditions of the elevated road are favorable for electric traction, and that Manhattan will be able to operate, as far as the cost of transportation is concerned, cheaper than a surface road. While insiders in Manhattan are willing to give some favorable estimates in regard to future earnings, they do not say much in regard to the stock, and there is reason for thinking that the Gould interest is not disposed to encourage a rise until after the election, no matter what the prospects may be. The Manhattan railway has at last arrived at a period where it has ceased to suffer a loss of patronage due to the competition of the improved surface roads. The decline in the Manhattan traffic has been continuous since 1893, until the last fiscal year, when its report shows a gain of about 10,000,000 passengers over 1899. Of this improvement, however, 8,000,000 was due to the transfer arrangement made with the Third Avenue Line. Traffic on the Manhattan declined from 221,000,000 passengers in 1893, to 174,300,000 in 1899.

BROOKLYN RAPID TRANSIT REPORT.—The report of the financial operations of the Brooklyn Rapid Transit Company for the year ended June 30 last, was given out last Friday afternoon. The receipts from all sources were $11,768,550, an increase of $452,517 over the previous year; total expenses, including taxes and net fixed charges, $11,241,778, a decrease of $276,136; surplus, $526,772, an increase of $728,653. The operations of the Kings County Elevated for June, July and August, 1900 and 1899, are not included in these figures, the company having been operated independently during that period. The assets include the following items: Cost of road and equipment, $85,984,973.47; additions and betterments not yet distributed, $85,773.39; supplies, $516,606.88; cash on hand, $1,470,287.54. Among the liabilities are these items: Capital stock B. R. T. Co., $45,000,000; capital stock of constituent companies not owned by B. R. T. Co., $1,540,674.45; funded debt, $52,474,040; taxes accrued, $596,052.04; rental accrued, $686,140.19; audited vouchers, $641,396.85; surplus, $623,425.75. The surplus is sufficient to pay a dividend of 1 17-100 per cent. on the $45,000,000 capital.

WESTERN UNION.—An old story is revived in reports that W. K. Vanderbilt has acquired a new large interest in the stock of the Western Union Telegraph Company. One new detail represents Mr. Vanderbilt as being engaged in a conciliatory plan whose success will bring about a consolidation of Western Union and Bell Telephone. Mr. Russell Sage says "the story is crazy." Assistant Superintendent Levin, of Western Union, says in an interview: "Western Union is doing a good deal of construction work in the West this year. We are putting in a new copper wire from Helena to Ogden, and new wires are being put up from Havre to Everett, Wash., passing through Spokane. Two wires have been run from Chicago to Houghton, in the copper region, in the last year. There are more leased wires in the Northwest than ever before, and there is a steady increase in the company's commercial business in that section. In some localities our business seems to have fallen off somewhat, but in the West a material increase is shown."

AMERICAN TELEPHONE BONDS.—Some misunderstanding has arisen with respect to the recent sale of American Telephone Company bonds to the Kidder, Peabody & Co. Syndicate as to the amount of bonds now outstanding. In the early part of January last the American Telephone and Telegraph Company made arrangements with them for financing the needs of the company for the year 1900 to the extent of $10,000,000; the arrangement was partly firm and partly on options. Of the above $10,000,000 bonds the syndicate at that time purchased $6,000,000, the options on the remaining $4,000,000 not having been exercised. The present arrangements are that the syndicate now takes these $4,000,000 bonds, and has options on $5,000,000 more, so that if the present options are exercised the total outstanding American Telephone and Telegraph bonds will be $15,000,000, and not $20,000,000, as generally supposed.

PITTSBURG ROADS—Mr. M. K. McMullin, a broker, who is prominent in the organization of the Pittsburg Union Traction Company, has purchased the West End Traction Company outright for a cash price of nearly $4,500,000. This is said to be practically the consummation of a deal by which the West End Passenger Railway Company will pass into the control of the Union Traction Company. The Union Company is expected to control, if pending plans are carried to a successful conclusion, the Consolidated Traction, the United Traction, the Monongahela Traction, and the West End Traction Companies, covering practically the entire County of Allegheny.

A PAYING TROLLEY.—The Montville Street Railway Company, which connects the cities of New London and Norwich (Connecticut), makes the following statement of earnings, from which it appears that the interest charge for the entire year has practically been earned in ten weeks, from June 5, the opening of the road, to August 12, 1900:

Gross receipts, June 5 to August 12, 1900	$19,500
Operating expenses (estimated)	7,500
Net receipts (estimated)	12,000
One year's interest on its $250,000 5 per cent bonds	12,500

AMERICAN TELEPHONE.—The officials of the American Telephone Company are not as yet prepared to state publicly the amount of deposits of American Bell Telephone stock for exchange into that of the American Telephone and Telegraph Company. A prominent

Boston banking house, however, identified with telephone interests, places the amount of American Telephone stock now outstanding at about $90,000,000; the authorized issue is $100,000,000. The market value of the collateral underlying the 4 per cent. bonds of the American Telephone Company is declared to be 33 per cent. in excess of the par value of the bonds issued.

GENERAL ELECTRIC.—On Monday of this week General Electric was easily the feature of the market, rising at one time nearly 5 points, and closing with a net gain of 3¾ points on sales of 1,100 shares. The old story of a probable consolidation of the company with the Westinghouse Company was revived, but there seems to be no more foundation for the report now than at any time in the past. One report had it that the dividend will be increased. It is said that lately there has been good buying of the debenture bonds of the company, and that they are being converted into stock.

DIVIDEND.—Kings County Electric Light and Power Company has declared a dividend of 1½ per cent, payable September 15.

Commercial Intelligence.

THE WEEK IN TRADE.—The reviews of trade published by the commercial agencies indicate better underlying conditions, in the leading Western centers there being evidences of further expansion in fall trade. Steady increases in current gross railway earnings over a year ago and an exceptionally favorable net earnings report for the first half of the year are additionally encouraging features. The list of unfavorable elements in the trade situation is at best a negative one, namely, the approach of the Presidential campaign, though less effective than usual in this respect, the dullness in building materials, notably lumber, being among these. Speculation in nearly all lines, and especially in food products, is at a low ebb, and what price changes are noted are mainly because of this, though weather and crop conditions have played some part in wheat, corn, and cotton, respectively. There is an increasing demand for money in the West, where trade is expanding; but the call for money to move the crops has not yet made itself heard. It is thought that bottom prices have been reached in iron and steel. Except steel rails, all forms of iron, from ore to the finished product, are being sought more eagerly and with less effort to secure further concessions in price. Bridge and boat builders buy structural material, both for domestic use and export, while the foreign demand for pig iron at Southern mills is heavy, though vessel room is limited. Bradstreet reports the number of failures last week as 168, against 172 the week previous, and 195 the corresponding week last year. Copper stocks assumed a place of some prominence, and substantial advances were made by several issues of this group. Amalgamated was generally strong, but there was not much trading in it, the average daily sales not being more than 200 or 300 shares. Union Copper was fairly active at 2 and 2⅛, closing at 2 bid. The closing quotations were 16¾c for lake and 16⅝c for electrolytic. Regarding the advance, John Stanton, a well-known local copper dealer, says: "Copper is in a very strong position. The increase in the production of the metal has not been as large as was anticipated, and the demand for export is very large. Official statistics show that the consumption in England, France and Germany for the first half of this year has been 38 per cent. greater than in the corresponding period of last year."

EXPORTS OF ELECTRICAL MATERIAL.—The following were the exports of electrical material from the port of New York for the week ended Aug. 18: Antwerp—24 packages electrical material, $2,770. British Possessions in Africa—12 cases electric machinery, $1,476; 12 packages electric material, $1,713. Brussels—1 package electric material, $246. Brazil—72 packages electric material, $9,219; 20 packages electrical material, $652; 27 packages motors, $270. British West Indies—16 packages electrical material, $268. Christiana—6 cases electrical material, $550. Cuba—31 cases electrical material, $892. Chili—13 cases electrical material, $474. Central America—47 cases electrical material, $683; 3 cases electric machinery, $130. Canary Islands—48 cases electrical material, $327. Cologne—12 cases electrial material, $605. Copenhagen—11 cases electric motors, $413. Dundee—1 case electric machinery, $350; 7 packages electric material, $702. Ecuador—3 cases electrical material, $66. Genoa—5 cases electrical machinery, $110. Hamburg—170 packages electrical material, $10,446. Hayti—2 packages electrical material, $13. Hull—22 cases electric motors, $3,885. Huddersfield—11 packages motor trucks, $2,189. Havre—19 cases of electrical machinery, $863; 56 cases electrical material, $9,010; 2 cases automobile parts, $50. Japan—2 cases electrical machinery, $170. Liverpool—49 packages electrical machinery, $1,700; 63 packages electrical material, $5,068; 150 cases motors, $9,653. London, 169 packages electrical machinery, $6,530; 168 packages electrical material, $8,564; 38 packages motors, $1,900; 30 cases trolley poles, $950. Mexico—60 cases electrical material, $1,416; 2 reels cable, $477. Marseilles—23 cases electrical material, $1,944; 17 cases motors and parts, $2,000. Newfoundland—10 cases electrical material, $313. Nova Scotia—3 packages electrical material. $35. Newcastle—52 cases motor machinery, $7,000. Norwich—1 case electrical material, $18. Porto Rico—35 packages electrical machinery, $5,600; 24 packages electrical material, $316. Peru—15 cases electrical material, $573. Plymouth—1 case electrical material, $5. Rome—1 package insulators, $8. San Domingo—17 cases electrical material, $274. St. Petersburg—1 box electric motors, $135; 35 cases electrical material, $3,123. Southampton—25 cases electrical material—$1,390. Siam—3 packages electrical material, $426. Venezuela—51 boxes electrical material, $138. Wiborg—68 packages electrical material, $1,282.

SAULT STE. MARIE POWER.—Mr. Charles E. Turner, United States Consul-General at Ottawa, Canada, says: "The industries of Sault Ste. Marie are rapidly becoming important. There are on the Canadian side of Sault Ste. Marie the Algoma Commercial Company, the Canadian Steel Company, the Sault Ste. Marie Pulp and Paper Company, and the Lake Superior Power Company. American power companies are supplying power to the numerous companies above mentioned, and are also supplying the city of Sault Ste. Marie with both electric and water power. They have at the present time a capacity for developing 16,800 horse-power by forty-two turbine wheels of 400 horse-power each. The intention is to construct an additional one of much larger capacity in the near future. The pulp company is turning out 150 tons of pulp per day, practically all of which goes to France, Germany, and England. The managers have a large sulphide plant under construction, which will be finished in a very few weeks, and have an output of 75 tons of chemical pulp per day. They also have very large iron works, and manufacture a great deal of their machinery, including many electric appliances, and they have made in their own works the iron columns for their new buildings. They have also under way smelting works for the manufacture of pig iron, and, with the addition of the nickel ore received from their own mines at Sudbury, will make "ferro-nickel pig." These companies also control on the American side of Sault Ste. Marie, Mich., the Lake Superior Power Company, the Union Carbide Company, American Alkali Company, and the Michigan Reduction Company. They are constructing a canal on the Michigan side and water-power works which will contain three hundred and sixty turbine wheels with a capacity of 125 horse-power each. The capitalization is $3,500,000, and the works will cost that when completed. The water power on the Michigan side will also be used to run factories similar to those now on the Canadian side, with a carbide mill and an alkali factory in addition. The product of the Carbide mill is owned by the Carbide Company, of Chicago, and the product of the alkali factory by the American Alkali Company, of Philadelphia.

TRAIN LIGHTING.—At a recent meeting of the stockholders of the Consolidated Railway Electric Lighting and Equipment Company, held at the general offices of the company, at 100 Broadway, New York, the following board of directors was elected: Walter Lüttgen, Norman Henderson, C. G. Kidder, George W. Knowlton, Thomas J. Ryan, Isaac L. Rice, John N. Abbott, Augustus Treadwell, Jr. The vice-president and general manager of this company, John N. Abbott, was formerly general passenger agent of the Erie Railroad, and subsequently for several years chairman of the Western Passenger Association in Chicago. The Consolidated Company is an amalgamation of the various companies heretofore engaged in the manufacture of electric lighting apparatus for all kinds of steam railway cars, the current being generated from the car axle while the car is in motion, fed into and then furnished from a storage battery while the car is stationary. This system is known as the "Axle Light" system of electric lights and fans for railway coaches, and is in operation on various railway lines.

APPARATUS FOR OTTAWA.—In the Ottawa Electric Company's new plant the two-phase alternating current generators will enable the company to furnish, in addition to its present services, current for alternating current or induction motors for all power purposes. The contract for the arc lighting generators has been awarded to the Western Electric Company, of Chicago and New York, and the contract for the large generators, induction motors and all the other electrical apparatus, has been signed with the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa.

CUT IN STRUCTURAL STEEL PRICES.—The structural steel manufacturers of Pittsburg August 15 announced a cut of $8 a ton The reduction is said to be a retaliatory action against the American Steel Hoop Company and the American Steel and Wire Company. These two corporations are accused by the structural steel manufacturers of having lately supplied the market with shapes at as much as $10 a ton below the pool agreement rate.

The CROCKER-WHEELER COMPANY, in order to handle its increasing business in Pittsburg and vicinity, has established a sub-office in room No. 607, Empire Building, under the management of Mr. Francis B. DeGress. He has been associated with the Crocker-Wheeler Company for many years and is an engineer of wide experience in factory equipments, both electrical and mechanical.

Special Correspondence.

ENGLISH NOTES.

LONDON OFFICE, ELECTRICAL WORLD AND ENGINEER, Aug. 11, 1900.

THE METROPOLITAN.--The half-yearly general meeting of the Metropolitan Railway Company was recently held under the presidency of Mr. John Bell. After making a statement that the result of the half year's working was that they carried to net revenue a balance of £202,004, out of which it was proposed to declare a dividend of 3¾ per cent per annum, Mr. Bell referred to the following clause in the report which had just been submitted: "In view of the importance to the Metropolitan and District Railway Companies of adopting electricity as a motive power, a committee consisting of three members from each of the boards of the companies has been appointed to consider the question of applying electric traction to the working of the Inner Circle, and it has been agreed between the companies to invite eminent electrical traction firms to submit plans and specifications, with detailed estimates and tenders for the necessary installation." It thus seems very certain that before long part of the underground system at present operated by steam by the Metropolitan Company will be converted to electrical working. The directors have satisfied themselves by the experimental train which they have had working near Earls Court for the past few months that it is quite possible to convert their system to electricity. The problem which they have is naturally one of considerable difficulty, but it is one also that can be readily accomplished, if they once determined to make the change. It must, of course, be borne in mind that it is not a new railway that they have to construct, but the conversion of an existing railway constructed for steam power and carrying something like 100,000,000 passengers per annum. This enormous traffic must be worked without a hitch while the change from steam to electric traction is being made. There is no doubt that public opinion has forced the company to adopt electric traction, and the new electric railroads which have just been opened, the Central London and the extension of the City and South London Electric Railway have proven so conclusively to the directors that electricity is the popular mode of traction for underground roads and that they themselves will have to give a better means of transport than by the old steam locomotives. It is to be hoped, therefore, that all preliminary work will be accomplished as soon as possible and that the company will procure plans and specifications and begin the work of conversion in the near future.

ANNUAL MEETING OF THE ELECTRIC CONSTRUCTION COMPANY.—At the seventh annual meeting of the Electric Construction Company, Ltd., of London and Wolverhampton, a few very interesting remarks on the condition of the electrical trade and the growing possibilities of retaining more of the work in Great Britain, were made by the deputy chairman, James W. Barclay. After announcing that the general outcome of the business for the past year was a profit of £21,729 1s. 9d., which sum was utilized to pay the fixed preferential dividend, and to distribute 6 per cent to the ordinary shareholders, a balance of £4777 1s. 9d. being carried forward. The cost of maintaining the works, renewing and upholding the plant, adequate provision for bad debts and other liabilities, and adding £5000 to the general depreciation account all came out of profits as usual. The company has spent £5798 during the year for additional tools, and nearly £10,000 has been paid for an extension of its existing plant. The Electric Construction Company has just completed an addition to its workshops, and this is now being filled with tools and appliances of the latest improved description for facilitating the out-turn of work and for reducing the amount of hand labor in the process of construction. Mr. Barclay stated that when the shops were finished he did not hesitate to say that they would be in every respect the best in the United Kingdom for manufacturing large electric machines. Mr. Barclay went on to say that during the past year they had "successfully completed the equipment of the City & South London Railway extensions with plant and appliances of exclusively British manufacture. This seems to be a sufficient answer to those who assert that British manufacturers cannot produce the best machinery for electric traction. The system adopted on the City & South London Railway to meet the condition of distributing power over a considerable length of line from one generating station has not been borrowed from the United States, and it was, indeed, I believe, prophesied by some of our transatlantic competitors that the system would prove a failure, but those prophets seem to have forgotten that the Electric Construction Corporation equipped the Liverpool Overhead Electric Railway before there were any overhead electric railways in America. We have never failed in any work we have undertaken yet. These facts should encourage British corporations to have more confidence in their own countrymen and not accept implicitly the assertions of interested rivals." As an example of the excellent relations which exist between the board and the employees of all classes in their factory, and also as an example of the advanced spirit in which the works are managed, it is interesting to note that the company has sent to Paris during the Exposition some twenty or thirty of its leading men, in order that they might see in the exhibition what is being done in electrical machinery in other countries.

General News.

THE TELEPHONE.

VALDOSTA, GA.—The Mutual Telephone Company is being organized.

ORANGEBURG, S. C.—A new and independent telephone company is talked of here.

DUBLIN, GA.—The Georgia Telephone Company, Savannah, Ga., will build a line from Savannah to Macon.

HAGERSTOWN, IND.—The City Council has granted a franchise to the Hagerstown Telephone Company.

FLATONIA, TEX.—Men are at work constructing a telephone line to embrace all neighboring towns and villages.

CHICOPEE, MASS.—The Board of Aldermen has granted a franchise to the Hampden Automatic Telephone Company.

MONETT, MO.—The Barry County and Southwestern Missouri telephone companies are at war over right of way.

BALDWIN, WIS.—A stock company of local business men has incorporated and will put in a local telephone exchange.

TROY, OHIO.—The Miami Telephone Company is making connection with exchanges in Xenia, Middletown and Cedarville.

GREENSBORO, N. C.—T. J. McAdoo and others have incorporated the Greensboro Telephone Company, with a capital stock of $50,000.

CIRCLEVILLE, OHIO.—The Circleville Citizens' Telephone Company has installed an exchange at New Holland with toll line to this place.

CHERUBUSCO, IND.—The Independent Telephone Company, recently organized in this city, opened for business Aug. 1, with good patronage.

LONG ISLAND CITY, L. I.—The New York and New Jersey Telephone Company is laying wooden conduits for an underground system in this city.

HAMPTON, VA.—The Hampton Telephone Company has been chartered. Capital, $25,000. Incorporators: W. E. Lawson, H. W. Saunders, both of Hampton.

HOME, TEX.—The Home Telephone Company has been incorporated with a capital stock of $600, by W. L. Higginbotham, G. H. Baxter, J. H. Thompson and others.

COLUMBIA, S. C.—The new South Carolina Telephone Company has begun business at Columbia, with 125 telephones, and new ones are being added at the rate of 20 per day.

LATTIMORE, N. C.—A new telephone line is being built to connect Lawndale, Lattimore, Murfreesboro and Boiling Springs, N. C., with the exchange located at Lattimore.

HIGH SPRINGS, FLA.—An independent system of telephone lines will be installed here. The Council has granted a 50-year franchise, and the promoters are actively at work.

RACINE, WIS.—The Racine Mutual Telephone Company will be incorporated. The system is to be built in accordance with a franchise granted to Allen Scheuman a year ago.

SPARTANSBURG, S. C.—On Sept. 4 a meeting of the stockholders of the Citizens' Telephone & Telegraph Company will be held here to consider the question of a $50,000 bond issue.

COLUMBIA, S. C.—The State house at Columbia, which is to be improved at a cost of nearly $160,000, will be rewired. The McIlvaine-Unkerfer Company, of Pittsburg, is the contractor.

ST. LOUIS, MO.—The Kinloch Telephone Company is putting in an immense cable at Seventh and Pine Streets, the largest in the city. It is 3 ins. in diameter and contains 800 wires.

RIDGEVILLE, IND.—The Ridgeville Telephone Company has been incorporated, with a capital of $9,000. R. O. Frazu, D. G. Heister, E. E. Hiatt and M. T. Sumption are the directors.

ARCADIA, ILL.—The Liter Arcadia Telephone Company, of Arcadia, has been incorporated. Capital, $1500. Incorporators: R. F. Henderson, D. E. Kennedy, L. A. Barr, all of Arcadia.

RALEIGH, N. C.—The Raleigh Telephone Company will be ready for business about Oct. 1. This will give this city three telephone systems, a larger number than in any other town of the State.

FALLS CHURCH, VA.—The Falls Church Telephone and Telegraph Company, with a capital stock of $5000, has been incorporated by M. E. Church, B. E. Williams, E. J. Northrup and others.

NEW CONCORD, OHIO.—The New Concord Telephone Company has been incorporated by L. J. Graham, A. M. Shipley, John B. Bain, T. J. Rader and S. W. Loviner. Capital stock, $10,000.

SALEM, OHIO.—The Columbiana Telephone Company is negotiating for the line to Phœnix and Toronto. Connection with Pittsburg and Steubenville will be opened by the company on Sept. 1.

LINTON, IND.—Patrick G. Farrell, principal owner of the Linton Telephone Company, has sold the plant to the Home Telephone Company, of Bloomfield. The consideration is understood to be $15,000.

TOLEDO, OHIO.—Over $75,000 is being expended in improvements to the Central Union Telephone Company's exchange in this place. New switchboards and new instruments are being installed.

PITTSBURG, PA.—The Bell Telephone Company is building a new trunk line from Pittsburg to Uniontown, via Banning, Perropolyis and Upper Middletown, to accommodate the pressure of business.

COVINGTON, OHIO.—The system of the Covington Telephone Company has been placed in operation with 100 telephones. Farmers in the surrounding territory are asking for connection for their community lines.

WHITEHALL, WIS.—The Anadia Telephone Company is building a line from here to Pigeon Falls and Hoh, where it will connect with the Osseo Telephone Company. The Osseo Company will build from there to Madison.

SALEM, OHIO.—The Columbiana County Telephone Company is extending its lines to Damascus, Hammondsville and Steubenville. Negotiations are under way for the purchase of the Phœnix exchange and toll lines at Steubenville.

WAYNESBORO, VA.—The Waynesboro Mutual Telephone Company has been chartered. Capital, $5,000. Incorporators: W. Patrick, N. C. Watts, both of Staunton; J. F. Carr, of Waynesboro; Patrick & Gordon, attorneys, Staunton.

INDIANAPOLIS, IND.—The total increase in the assessment of corporate telephone property in Indiana for the year amounts to $1,336,541. This is due to the general increase in the number of independent telephone lines throughout the State.

ALBANY, N. Y.—The Co-operant Telephone Company, of Dresden Station, Washington County, N. Y., has been incorporated. Capital, $15,000. Directors: R. N. Clemons, Dresden Station; J. A. McLaughlin, Putnam; E. J. Gray, Whitehall.

ROMNEY, W. VA.—The Romney and Cumberland Telephone Company has been incorporated. Incorporators: J. H. C. Pancake, Wm. S. Guthrie and G. N. Nutter, of Romney; R. M. Washington, of Springfield, and others. Authorized capital, $5000.

COLUMBUS, OHIO.—The Butler County Western Telephone Company, of Philanthropy, has been incorporated. Capital stock, $5,000. Incorporators: John Moorhead, Clem Corn, S. E. Fye, John Gillespie, W. A. Beard, R. D. Gillespie and W. S. Beard.

ST. CHARLES, MO.—Soundings and surveys for the reconstruction of the American Telephone & Telegraph Company's lines across the Missouri River at this place are being made. It will be necessary to change the presnt location, in order to make the repairs required.

RICHMOND, VA.—The Long Distance Telephone Company, of Staunton, has been incorporated. Capital, $100,000. Incorporators: J. R. Kemper, W. H. Laughlin, F. M. Hanger, N. C. Watts, A. Bowling, E. Echols all of Staunton; J. S. Cochran, of Folly Mills; J. F. Clemmur, of Middlebrook.

CHARLESTON, S. C.—The Sea Island Telephone Company has been incorported with a capital stock of $10,000. The incorporators are F. W. Fowles, of Madmalaw Island; H. Blich and W. C. Geraraty, of Young's Island; E. M. Seabrook, of Edisto Island, and C. Bissell Jenkins, of Charleston.

SAN JOSE, CAL.—The San Jose (Cal.) City Council has decided to grant the San Jose Telephone Company a franchise on certain conditions. The new company is capitalized at $250,000, and proposes to build lines to San Francisco, Gilroy and Los Gatos as soon as the local system is in operation.

KINSTON, N. C.—An interesting contract has been completed between the town of Kinston, N. C., and the Kinston Telephone Company, whereby the company will in case of new competition give its subscribers the use of all telephones on both systems. This is done to protect subscribers in case of new companies entering the field.

ST. LOUIS, MO.—The comptroller is not satisfied with the report made to him by the Kinloch Telephone Company, and has sent the document back for a more complete statement of business transactions. The report covered only the period from Jan. 1 to July 1, and showed a business aggregating about $160,000 for the six months.

SANDUSKY, OHIO.—The City Council has passed an ordinance imposing a yearly license fee of $1 each on all telephone, telegraph and trolley poles within the city limits. According to the civil engineer's report, this will yield an income of $3,425. It is stated that the telephone and railway companies will fight the ordinance.

CHICAGO, ILL.—The Northern New York Telephone and Telegraph Company, of Chicago, Ill., has been incorporated to do a general telephone and telegraph business. Capital, $200,000. Incorporators: A. E. Stilwell, G. E. Milligan, D. S. Lander, S. B. Willey, M. Hubbert, all of Chicago; D. S. Lander, attorney, Chicago, Ill.

RICHMOND, VA.—The Louisa Telephone Company's new line has been completed from Richmond to Louisa Courthouse and Gordonsville and intermediate points. This line is one of the links of the recently organized independent company, the Virginia Long Distance Telephone Company, whose lines are to reach all principal Virginia points.

LANSING, MICH.—Under a recent amendment to the law, telephone taxes are now payable in July instead of January, as formerly. The Michigan Telephone Company has paid the State treasurer $31,522.68 on account of the following lines, which it controls: Michigan, $22,967.67; Detroit, $4,837.43; New State, $2,814.64; Central, $522.10; Kalamazoo, $350.88.

SHELBYVILLE, IND.—The Mutual Telephone Company, owned by residents of this county, has over 500 instruments in use in the county, 300 of which are outside this city. The Central Union has, in addition to furnishing many free telephones, reduced its rate from this city to Indianapolis from 25 cents to 15 cents. This will, it is believed, precipitate another fight.

PITTSBURG, PA.—The Federal Telephone Company has completed the wiring of the towns of Wilmerding and Pitcairn, in this county, and the places were joined for operation on Aug. 10. The Pittsburg and Allegheny Telephone Company has also been granted the right to place its wires in Wilmerding, and, with the Bell Company, Wilmerding will soon have three telephone lines.

MADISON, WIS.—The State Tax Commission has sent out notices of hearings to be given the telegraph and telephone companies doing business in the State. It is understood that, following these, hearings will be given to street railway companies, and possibly light companies. The hearing of the telephone companies was held Aug. 21 and that of the telegraph companies Aug. 16.

CARTHAGE, MO.—T. J. Hyman, secretary of the Illinois Steel Company, has purchased the Interurban Telephone, east of Carthage, and will connect Monett, Springfield, Pierce City and Reeds with the Carthage line, thus giving Carthage connection with all the important towns in Southwestern Missouri. Mr. Hyman is an extensive owner of independent telephone systems and exchanges in the West and South.

TERRE HAUTE, IND.—The independent telephone companies of Western Indiana and Eastern Illinois have reached a basis of co-operation on which to prorate the long-distance receipts. By the new agreement service will be bettered and extended to 500 towns in the two States. The Kinloch Company, of St. Louis, is now building a long-distance line from St. Louis to Indianapolis that will pass through this territory and widely extend the service.

ALLIANCE, OHIO.—The Central Union Telephone Company is making extensive improvements in Alliance and vicinity. The local exchange is being equipped with new switchboards, and new instruments are to be furnished subscribers. Toll line connection is to be made with the villages of Garfield, Damascus and Homeworth. An additional line is being built to Pittsburg, and a direct line to Cleveland; also two additional lines to Canton.

TWO HARBORS, MINN.—With the installation of the switchboard in the new central office here and the completion to Duluth of the Duluth & Iron Range Railway Company's new telephone line, connection can now be had with Minneapolis, St. Paul and Chicago over the Bell Telephone Company's lines from Duluth. The Iron Range system is nearly completed to Biwabik, Minn., and as soon as the switchboard is put in there to connect with the Mesaba Telephone Company's line, Virginia, Biwabik, McKinley, Sparta, Eveleth and Mountain Iron will also enjoy the same connections.

PITTSBURG, PA.—According to a local city ordinance the telephone companies operating in the city of Pittsburg are taxed for each pole they put up within the city limits. Last year the Central District and Printing Telegraph Company was taxed for 146 poles, but this year the company appealed to the authorities, alleging that they did not have that many poles up. A municipal officer was detailed to count the poles, and he discovered that the company has only 73 poles erected. Now the assessors are wondering what can have become of the other 73 poles that were up last year.

DEERFIELD, WIS.—Rural telephone systems are becoming quite common in eastern Dane County. About one year ago a company was organized for the purpose of building a line from Cambridge to the Prairie Queen creamery. Some time ago the line was extended from Prairie Queen to the village of Utica. The line is in connection with the farm houses along the route, and is free to all shareholders who furnish their own telephones. A month ago another company was organized to construct a line from Deerfield to Utica, and the work is drawing near completion. The farmers all along the route are putting telephones in their houses, and each shareholder in this company will be required to pay a rental of $2 a year. Recently money was raised for the construction of a third line from Utica to Stoughton, and in a short time a fourth will be constructed from the same point to Edgerton, where it will connect with the Dane County system and the farmers in the neighborhood will have direct connection with Madison. It is further planned to build still another line from Utica to McFarland and Madison. Thus it will be seen that Utica will become an important telephonic centre, the meeting place of five different lines.

ELECTRIC LIGHT AND POWER.

HASTINGS, NEB.—An electrical plant is being installed in this city.

EVERGREEN, ALA.—The $25,000 electric light and water works bonds will probably be issued.

PLATTSMOUTH, NEB.—An electrical plant is being established in this place, and it will be run by gasoline engines.

LOWELL, MASS.—The Lowell Electric Light Company has voted to increase its capital stock from $300,000 to $400,000.

ALTON, ILL.—The power plant of the Alton Electric & Service Company broke down on Aug. 9 and will be disabled for a month.

JEFFERSON CITY, MO.—A statement of increase of capital stock has been filed by the Rankin Electric Light & Power Company.

CASPAR, WYO.—The electric light plant of the Caspar Electric and Refining Company has been completed and is now in running order.

CLEVELAND, OHIO.—O. R. Bissell, of this place, has obtained a 25-year franchise to operate an electric light and power plant at Bergen, N. Y.

SANDUSKY, OHIO.—The Nielson Entertainment Company, which is building a new opera house here, will shortly place contracts for a complete equipment of theatre electrical apparatus. E. T. Slack, a local electrician, is in charge of the work.

MASSILLON, OHIO.—The State hospital here is to have a lighting plant. Contracts were closed a few days ago with the Westinghouse Company for a 110-kw generator; Russell & Company, Massillon, a 150-hp engine, and the Heine Safety Boiler Company, St. Louis, for a 350-hp water-tube boiler.

VAILSBURG, N. J.—The Vailsburg Common Council has awarded the contract for lighting the streets of the borough to the People's Electric Light and Power Company, the present holders of the contract. Their bid for five years was: Thirty arc lamps at $90 a year; forty or more incandescent lamps at $15 a year.

KENTON, OHIO.—This town has been in darkness for several weeks, and there is little probability that the differences existing between the local electric lighting company and the Council will be settled. The majority of the Council members are determined to erect a municipal lighting plant, and they are desirous of securing figures on a plant to furnish 110 arc lights of 2000 candlepower.

SAN FRANCISCO, CAL.—The Truckee River General Electric Company has completed its pole line from Floriston, Cal., to Virginia City, Nev. The company recently held its annual meeting in San Francisco, when the following officers were elected: Mortimer Fleishacker, president; James Newlands, first vice-president; Sigmund Schwabacher, second vice-president; Herbert Fleishacker, secretary.

DENVER, COLO.—Judge Le Fevre refused to issue an injunction restraining the city officials from entering into a contract with the Lacombe Light Company to furnish the city with electric lights for a period of 10 years at the rate of $95 per light each year. The effect of the decision will be to reduce the price of electricity for lighting and power purposes in Denver, as the new company intends to compete for business with the Denver Consolidated Gas and Electric Company, which has had a monopoly.

SAN FRANCISCO, CAL.—The Independent Electric Light & Power Company, San Francisco, recently started up its new electric power station, and is ready to extend its business as rapidly as connections can be made with its commercial circuits. One 500-kw and two 1500-kw Westinghouse two-phase generators are now in commission, and the electric system has been turned over to the Independent Company as far as completed. Rotary transformers are used for motor circuits. The initial voltage is 500 volts, stepping-up to 11,000.

GRAND FORKS, B. C.—The Granby Smelter at this place, with a capacity of 1000 tons per day, has started operations. The smelter is electrically driven. The power is generated by a duplicate set of 16-in. turbine wheels. A dam was built across the north fork of Kettle River, and a flume, one mile long, carries the water to the power house, where 1200 horse-power are developed at low water. The saving, as compared with steam-power, is estimated at from $50,000 to $75,000 per annum. A portion of this power will ultimately be transmitted to the various mines of the Miner Graves syndicate.

THE ELECTRIC RAILWAY.

AKRON, OHIO.—The Northern Ohio Traction Company has decided to double-track several of its lines in this city.

READING, PA.—The United Traction Company is laying out a route for an electric railway from Reading to Boyertown.

CHATTANOOGA, TENN.—It is stated that the Chattanooga Electric Railway Company has decided to extend its line to Sherman Heights.

BATTLE CREEK, MICH.—The Common Council has granted a franchise through the city to the Battle Creek & Coldwater electric road.

ANDERSON, IND.—The Union Traction Company has contracted with the Government to carry mail for 3 cents per mile regardless of quantity.

FARMINGTON, MO.—The City Council, Aug. 10, granted a franchise for an electric railway to W. E. Stevenson & Co., Indianapolis, Ind.

INDIANAPOLIS, IND.—The Indianapolis Street Railway Company has broken ground for a new power station on West Washington Street.

PORTSMOUTH, VA.—It is stated that the Portsmouth Street Railway Company will build extensions and make other improvements to its property.

STEUBENVILLE, OHIO.—The Ohio River and Smithfield Electric Railway Company has been incorporated for $10,000; the headquarters are in this city.

BRISTOL, R. I.—The Town Council has granted the Suburban Railway Company, of Providence, the right to connect with the lines being built in Warren.

LONDON, OHIO.—The Columbus, London & Springfield Railroad Company has been granted a franchise by the County Commissioners of Madison County.

ADRIAN, MICH.—The Adrian Street Railway Company is about to let contracts for the re-construction of its lines. A complete equipment will be needed.

TWO RIVERS, WIS.—A franchise was presented to the City Council for the right of way to construct an electric railway from Manitowoc to Two Rivers.

MITCHELL, IND.—An electric railway has been projected to connect Oolitie City, Bedford, Mitchell, Orleans, Paoli and West Baden and French Lick Springs.

NEW YORK, N. Y.—Storage battery cars are now in operation on the cross-town line connecting the West Forty-second and the East Thirty-fourth Street ferries.

DETROIT, MICH.—The International Construction Company, of Detroit, was awarded the contract for building the Flint, Saginaw & Bay City Electric Railway.

AGAWAM, MASS.—The Springfield Street Railway Company has secured a franchise in this town for its proposed line from Springfield to the Connecticut State line.

TOLEDO, OHIO.—The Toledo Traction Company has placed contracts with the Toledo Bridge Company for an extension to its boiler house and for a new steel stack.

ELKTON, MD.—The County Commissioners have granted to the Cherry Hill, Elkton & Chesapeake City Railway Company, of Cecil County, a franchise for an electric railway.

SPRINGFIELD, OHIO.—The Clarke County Commissioners have granted a franchise to Harry Frey, of Springfield, for an electric road between Springfield and Clifton.

DECATUR, IND.—The Commissioners of this county have granted to L. B. McIlhenny, of Cincinnati, a franchise for an electric railroad between this city and Fort Wayne.

OKLAHOMA CITY, OKLA.—The City Council passed the ordinance granting the franchise for a street railway to the Oklahoma City Land and Electric Railway Company.

DES MOINES, IOWA.—The Keokuk Electric Railway and Power Company has been incorporated with a capital of $400,000. Incorporator: J. C. Hubinger, of Keokuk.

NEW ALBANY, IND.—The City Council has passed an ordinance granting the New Albany Street Railway Company a 30-year franchise, for which the city is asking only $200 per year.

COLUMBUS, OHIO.—The Urbana, Mechanicsburg & Columbus Traction Company has secured a franchise through Mechanicsburg and has made application for a franchise in Columbus.

BOSTON, MASS.—The Railroad Commissioners of Massachusetts have authorized the purchase of the Providence & Taunton Street Railway Company by the Taunton Street Railway Company.

DENNISON, OHIO.—A franchise for an electric road from New Philadelphia to Strasburg has been granted. This is one of the few links left of a complete line from Cleveland to Wheeling.

DAYTON, OHIO.—Dr. J. E. Lowes, engineer for the new road being projected by the Dayton & Northern Traction Company, has invited propositions for the electric and other equipment of the road.

WAVERLEY, IND.—The Indianapolis & Martinsville Electric Railway Company has completed its financial arrangements, and bids have been received for the construction of a power house at this place.

LIMA, OHIO.—The Lima Railway Company has amended its charter, changing its name to the Lima Electric Railway & Light Company. The capital stock has been increased from $200,000 to $500,000.

INDIANAPOLIS, IND.—The State Tax Board has assessed the Indianapolis Street Railway Company $3,500,000, raising the assessment of the County Board $1,000,000, from which an appeal was taken.

SPRINGFIELD, ILL.—The Secretary of State has licensed the incorporation of the East St. Louis, Madison & Granite City Railroad Company. The principal office will be in East St. Louis. The capital stock is $50,000.

CHARLEROI, PA.—A movement is on foot to build an electric road from Charleroi to Washington, Pa. Charleroi will vote $75,000 to the proposed road, and it is expected that Washington will subscribe a like amount.

TOLEDO, OHIO.—Frank J. Cheney, of Toledo, is at the head of a projected company, which proposes to build an electric line from Conneaut, Ohio, to Erie, Pa. The company is to be incorporated under the laws of Pennsylvania.

ASHEVILLE, N. C.—The Intermontane street railway of Asheville has been granted a franchise for extensive work. The Asheville & Weaverville electric line was also granted permission to make large additions to its present system.

PITTSBURG, PA.—The Westmoreland and Pittsburg Street Railway Company has begun the construction of the line joining Pittsburg with Greensburg, a distance of 28 miles. It is expected that the work will be completed by next fall.

GENEVA, OHIO.—P. W. Tuttle and C. F. Goodrich have obtained a right of way for a road between Geneva and Jefferson. They are also after a franchise from Geneva to Painesville to connect with the Cleveland, Painesville & Eastern road.

PENDLETON, IND.—The Indianapolis division of the Union Traction Electric Railway has been opened as far as this city, and cars are run regularly between here and Anderson. The company expects to get into Indianapolis by Sept. 15.

GRAND RAPIDS, MICH.—Ionia will be asked to grant a franchise for an electric road through that town to Grand Rapids. Promoters say the line will cost $500,000, and the money is ready to build it as soon as the franchise can be secured.

MT. HOLLY, PA.—The Carlisle & Mt. Holly Railway Company has been incorporated. Capital, $100,000. Incorporators: P. Russ, J. H. Worden, B. F. Meyers, H. M. F. Worden, all of Harrisburg; C. R. Alleman, C. S. Stucker, both of Steelton.

DAYTON, OHIO.—J. P. Wolf, John Barlow and others of this city are promoting a company and are securing right of way for an electric road between Lebanon, Centerville and Dayton. The two villages are anxious to secure telephone connections.

ANDERSON, IND.—The building for the large power house of the Union Traction Company is completed and the machinery is being installed. The entire plant will be in operation within a month, at which time the line to Indianapolis will be opened for traffic.

PITTSBURG, PA.—Superintendent Fitzgerald, of the Consolidated Traction Company, has issued an order to the motormen of the road prohibiting them from chewing tobacco. This order was made necessary on account of the frequent complaints from patrons.

PITTSBURG, PA.—The extension of the West End Traction Company of this city from its terminus in Carnegie to Leasdale was completed on Aug. 10, and the first car—a trolley party in charge of Mr. J. C. Reilly, the president of the road—was run in the afternoon.

ST. LOUIS, MO.—The St. Louis & Illinois Electric Railway Company has filed a first mortgage for $2,500,000 at Edwardsville, Ill. It was in favor of the Produce Exchange Trust Company of New York. The proceeds of the bonds are to be used in building the road.

ST. LOUIS, MO.—Articles of incorporation were filed by the Labor Union Street Railway Company. Its capital stock is placed at $5,000. Its officers are: President, Thomas B. Edwards; vice-president, Simeon O. Collins; secretary, William D. Benson; treasurer, John A. Roof.

ST. LOUIS, MO.—The Suburban Railway Company has completed surveys in the town of Ferguson, St. Louis County, for a new road that it proposes to run through that town, connecting with its Florissant division at Ramona Park, about two miles distant. The franchise has not yet been granted.

WASHINGTON, D. C.—The Post Office Department has opened negotiations with the North Jersey Street Railway Company and the Jersey City, Hoboken & Paterson Street Railway Company, with a view to using the trolley lines in Northern New Jersey for mail-carrying purposes.

PITTSBURG, PA.—The Northwestern Street Railway Company of Allegheny City has been chartered. Capital, $24,000. Incorporators: E. J. McIlvain, H. W. Klein, S. G. Paulin, D. A. Thompson, all of Allegheny; W. R. Heckert, of Pittsburg; S. H. McCain, of Bellevue; F. C. Sauer, of Aspinwall.

MIAMISBURG, OHIO.—The Miamisburg & Germantown Traction Company has been incorporated, with $50,000 capital stock, by William A. Mays, C. W. Dodds, S. H. Mays, A. J. Dwyer and A. F. Gwinn. The company will build an electric road from Germantown to Miamisburg, a distance of ten miles.

TACOMA, WASH.—The Seattle-Tacoma Electric Railroad Company recently received $100,000 as the first installment of the $1,000,000 subscribed by eastern investors for the completion of the line. The run between Seattle and Tacoma, Wash., will be made in 45 minutes, and the fare will probably be 25 cents.

NEWARK, OHIO.—B. G. Dawes, agent for the Chicago Equitable Trust Company, has turned over to W. S. Wright and his associates the Newark and Granville Electric Street Railroad, including the Newark city lines. The new company intends to build a new power house, add new cars and improve the service generally.

INDIANAPOLIS, IND.—The interurban electric lines centering in this city have declined to accept the provisions of the franchise offered them by the Board of Works and are preparing to establish terminals at the city limits. Unjust conditions and limited franchise to 20 years are the principal grounds for refusing to accept the same.

ALBANY, N. Y.—Articles of incorporation of the Albany & Schenectady Traction Company were filed Aug. 17. The company proposes to build a street surface road, nine miles long, from Albany to the Schenectady County line. The capital stock is $100,000, and the directors include Charles Pfizer, Jr., of New York City, and Jesse H. Leonard and T. E. Kerwin, of Albany.

CHICAGO, ILL.—Messrs. Sutro Brothers & Company, of New York, have filed a bill in chancery against the Chicago Union Traction Company, the Chicago Consolidated Traction Company and the directors of the Union Traction Company, to set aside the agreement of April 16, by which seven suburban feeder lines were consolidated with the Union Traction Company.

SAN FRANCISCO, CAL.—An electric railroad is projected from Fairfax to a group of mines on the Carbon River, in Western Washington. It is to be nine miles in length, of narrow gauge, and will transport ore to bunkers which will be constructed in Fairfax for loading Northern Pacific Railroad cars. There is water power available for an electric power transmission for operating the road.

ALBERT LEA, MINN.—The Albert Lea & Geneva Railway Company has filed articles of incorporation. The company proposes to operate an electric road between the points named, both in Freeborn County. The capital is $100,000, and the incorporators are George L. Carrington, Thorald V. Knatvold, Albert C. Wedge, Charles A. Hanson, Robert G. Ransom and Howard H. Dunn, all of Albert Lea, and Svend Svendson.

KEOKUK, IOWA.—The street car and electric light plants of J. C. Hubinger have been consolidated under the corporate name of the Keokuk Electric Railway and Power Company. The property has been bonded for $250,000. About $40,000 will at once be spent on improvements. The officers of the new company are John E. Craig, president; J. C. Hubinger, vice-president; Ed. F. Brownell, treasurer; Theodore Craig, secretary; J. B. Wallace, manager.

TIFFIN, OHIO.—The directors of the Tiffin, Fostoria & Eastern Electric Railway Company at their recent meeting elected the following officers: President and general manager, Samuel B. Sneath; vice-president, C. F. M. Niles; secretary and treasurer, Ralph D. Sneath; superintendent, A. I. Kaup. The road is now in operation between Tiffin and Fostoria, and will soon be completed into Toledo. Branches are being built to Findlay, Bucyrus and Fremont.

DAYTON, OHIO.—The Dayton, New Carlisle & St. Paris Traction Company has been incorporated, with a capital stock of $1,350,000. Incorporators: Charles E. Layton, H. N. Reynolds and John A. Brake, of Dayton, and B. H. Rannels and H. S. Forgy, of Clarke County. A private right of way has been secured and the construction work will be commenced about Oct. 1. The promotors have purchased a grove and lake near New Carlisle and a hotel and pleasure resort will be located there.

COLUMBUS, OHIO.—The Chillicothe, Mt. Sterling & Columbus Electric Railway Company has been granted a franchise by the Franklin County Commissioners. The work must be finished by Oct. 1, 1901, and a bond of $8,000 was required for building the road and $25,000 for any damages that might be incurred in rebuilding the Rich Street bridge. The bridge is to be remodeled at a cost of $12,000. A franchise ordinance introduced by the company has been approved by the Columbus Council Committee.

THE AUTOMOBILE.

THE MUNSON SAFETY AUTOMOBILE COMPANY has been incorporated at Trenton, N. J., with a capital of $125,000.

THE GENERAL AUTOMOBILE COMPANY has been incorporated at Trenton, N. J., with a capital stock of $125,000.

NO RACING IN NEWPORT.—The police commission of Newport, R. I., has refused to grant permission for the automobile and locomobile races for the prizes which W. K. Vanderbilt, Jr., intended giving. The refusal was made in view of the protests of the cottagers.

AUTOMOBILES IN MONTREAL.—It is announced that within a short time Montreal is to be supplied with automobiles. Mr. A. J. Corriveau is now completing arrangements for a system of vehicles. American capitalists, who are now operating a large factory in the United States, are interested in the enterprise.

THE CHICAGO AUTOMOBILE CLUB.—The first run and parade of the Chicago Automobile Club was held on Aug. 11. Sixteen vehicles started and others joined the party at different points along the line. There were four electric vehicles in the procession. The run was made to Edelweiss Garden, at Fifty-first Street and Cottage Grove Avenue, where the members stopped for supper. The Chicago Automobile Club is composed principally of the members of the old Western Automobile Club, which has been disbanded. It is the intention to make several runs during the summer and fall.

NEW INDUSTRIAL COMPANIES.

TRENTON, N. J.—The Darlington Electrical Fountain and Supply Company has been incorporated. Capital, $100,000.

THE GENERAL ELECTRIC STORAGE BATTERY COMPANY has been incorporated at Trenton, N. J., with a capital stock of $125,000.

TRENTON, N. J.—The Standard Electric Company has been incorporated. Capital, $25,000. Incorporators: J. M. Sawyer, B. L. Cates, both of Philadelphia.; F. C. Lowthrop, attorney, Trenton.

THE FLINT-LOMAX ELECTRIC & MANUFACTURING COMPANY has been incorporated in Denver, Colo., to deal in electrical supplies. Capital, $50,000. Incorporators: J. I. Flint, F. W. Lomax, Emma A. Hoard, Pattie Flint, Louise D. Lomax, all of Denver.

THE FORT WAYNE ELECTRIC WORKS, of New York, have been incorporated in Jefferson City, Mo. Capital stock, $500,000; capital stock in Missouri, $10,000; offices in St. Louis. The incorporators are: J. P. Felton, E. E. Gilbert, S. D. Greene and George C. Hollister.

TERRE HAUTE, IND.—The Indiana Burglar, Fire Alarm & Telephone Company has been organized in this city, with a capital of $50,000. The system and purposes are entirely new. A burglar and fire alarm, a police call and telephone combined, will be operated over the same set of wires.

PORTLAND, ME.—The Electric Fire Engine Company has been incorporated here. Capital, $5,000. The officers are: Walter A. Morgan, Portland, president; Ernest O. Hiler, Boston, treasurer; Walter A. Morgan and Llewellyn Carlton, Portland, and Ernest O. Hiler, Boston, directors.

RICHMOND, VA.—The Aron Electrical Company of America is being organized, with a capital stock of $500,000, to control the patents in this country of the Aron electrical meter for measuring electricity. Among those interested are Andrew Pizzini and J. Alph Pizzini, both of Richmond.

PHILADELPHIA, PA.—The Globe Electrical Manufacturing Company has been incorporated in this city, to manufacture and deal in electrical supplies. Capital, $250,000. Incorporators: G. E. Cooling, A. G. Coolidge, W. Mason, W. L. Tater, D. R. Paterson, all of Philadelphia, Pa.; D. R. Paterson, attorney, Philadelphia, Pa.

OBITUARY.

PITTSFIELD, MASS.—At Pittsfield on Aug. 20, a little before 2 a. m., three masked burglars broke into the house, in Burbank Street, occupied by R. L. Fosburg, of Buffalo, N. Y., contractor of the Stanley Electric Company's new buildings. They were heard by the inmates, and during a fight which ensued Miss May L. Fosburg was killed and her father and brothers were rendered insensible.

JOHN MONTGOMERY PENDLETON, one of the principal land owners of Staten Island, died on Aug. 18, at his residence, in New Brighton, S. I. Mr. Pendleton was born in Boston 66 years ago. He was educated abroad, and after his return to this country he made his home with his father, who had moved to Staten Island. During the war he engaged in the wool trade, making a fortune in a very short time. Later he became identified with the North Shore Ferry Company and other Staten Island enterprises. He married twice. He was deeply interested in electricity and was an inventor in the field of storage batteries, etc. He was at one time president of the New York Electrical Society and took a warm and lively interest in its affairs.

PERSONAL.

MR. F. S. TERRY, of the Weston Electrical Instrument Company, Newark, N. J., was in Chicago last week.

MR. GEORGE ROSE NEWCOMER, of the United States Carbon Company, Cleveland, Ohio, visited Chicago last week in the interest of his company.

MR. W. R. MASON, the representative of the Siemens-Halske Electric Company at St. Louis, Mo., is visiting Chicago, in the interests of his company.

MR. E. WARD WILKINS, of Partrick, Carter & Wilkins, electrical house goods, Philadelphia, is spending the month of August at Cayuga Lake, N. Y., and at the seashore.

MR. F. W. PILSBRY, for a number of years manager of the Fred W. Wolf Company at Chicago, recently resigned from his position with that company and has been appointed western manager for the York Manufacturing Company, York, Pa. An office will be opened in Chicago and several salesmen employed to look after the trade adjacent to that city, who will work under the direction of Mr. Pilsbry.

Trade Notes.

THE STERLING ELECTRIC MOTOR COMPANY, Dayton, Ohio, is permanently located in its new quarters, and is now prepared to make deliveries of its products.

PITTSBURG, PA.—Newell's Hotel in this city will be equipped with a 10-ton refrigerating plant. The York Manufacturing Company, York, Pa., has the contract for the installation of the necessary machinery.

SPRINGS.—The Wallace-Barnes Company, Bristol, Conn., makes a specialty of springs for electrical purposes. It has increased its plant and has up-to-date facilities for furnishing small springs of every description.

IDEAL AUTOMATIC ENGINES.—The Ideal automatic cut-off steam engine is the subject of a bulletin just issued by A. L. Ide & Sons, Springfield, Ill. The principal features of this engine are well brought out and illustrated.

OIL FILTERS ABROAD.—Two large shipments of Cross oil filters were made by the Burt Manufacturing Company, of Akron, Ohio, to France during the month of July, as the direct result of its exhibit at the Paris Exposition.

CABLE CONTRACT.—The city of Cleveland has awarded a contract for 16,000 ft. of telephone cable to the John A. Roebling's Sons Company. The price was $3,400. The cable will be used in making telephone connection with the new city water works cribs.

ADJUSTABLE SHADE LAMP.—The merits of the Espersen adjustable shade lamp are pointed out in a circular just issued by the Pacific Electric Company, La Crosse, Wis. The various styles and applications of these shade lamps are illustrated.

BLOMKUN BROTHERS, 150 Reed Street, Milwaukee, Wis., are increasing the scope of their business. They buy and sell second-hand electrical appliances. A large amount of electrical goods was purchased from the Omaha Exposition and will be received soon and put in the market.

THE ELECTRIC APPLIANCE COMPANY, Chicago, has just issued its new telephone catalogue, No. 15. It is most complete and up to date and is well arranged and handsomely printed. It should be in the hands of every one interested in telephones and telephone-line construction.

THE BRUCKNER ELECTRIC COMPANY, 136 Liberty Street, New York, of which note was recently made in these columns, has been incorporated at Albany, the capital stock being placed at $50,000. The directors are F. C. Bruckner and Paul Sheldon, of New York City, and W. L. Eastman, of Woodside, L. I.

CONCRETE MIXERS.—The Ransome & Smith Company, 17 Ninth Street, Borough of Brooklyn, N. Y., has issued a pamphlet describing the Ransome patent concrete mixers. These machines are illustrated, and copies of testimonial letters given indicate that these mixers perform their work in a very satisfactory manner.

"THE MECHANIC" is the title of a new magazine published in Smithville, N. J., in the interests of wood-workers. Mr. John Adams Heinson is the editor, and it is published by the Smithville Publishing Company, Incorporated. The first number contains matter of special interest to wood-workers, and a large double-sheet illustration of a large moulding machine.

WARD LEONARD ELECTRIC COMPANY, of Bronxville, N. Y., has been awarded the gold medal by the authorities of the Paris Exposition. As only few of the electrical manufacturers have been accorded the distinction which the gold medal affords, the Ward Leonard Company feels justly proud of the merit of its rheostats and circuit breakers which have won such prominent success.

OKONITE.—The Central Electric Company, Chicago, recently received an order from one of its old customers for 8830 ft. of Okonite wire of various sizes. The order was accompanied by a request that the goods be of the same quality of insulation as that of the sample, which was cut from some Okonite wire put in nine years ago. Time is the infallible test of insulation after all.

THE SPRAGUE ELECTRIC COMPANY reports an unusually large and steadily increasing business along all the lines of its manufactures. The Lundell fans have had a big sale and the sales in the interior conduit department have exceeded all previous seasons. The company has just issued a revised edition of the bulletin describing the Greenfield flexible steel armored conductors. It contains additional illustrations and prices.

"WOOD" AUTOMATIC MOTOR-STARTING RHEOSTAT.—The Fort Wayne Electric Works (incorporated), Fort Wayne, Ind., have issued bulletin No. 1011, descriptive of the "Wood" automatic, double-release, motor-starting rheostat circuit-breaker and switch, combined. The operation of this apparatus is described, and several illustrations show the device in various positions. It is made in sizes ranging from ¼ horse-power to 50 horse-power.

ARC LAMP POLE FIXTURES.—A complete line of fixtures of this kind, including brackets and extension rods, are illustrated in catalogue No. 30, just issued by the general Incandescent Arc Light Company, 572 First Avenue, New York. The Bishop crook lamp fixture is very handsomely designed, as shown by the illustration, and such poles are highly ornamental in the best of city streets. An illustration is also given of the G. I. arc lamp hanger reel.

ABOUT PAINT.—Those interested in paint will find a good deal of information on the subject in a little pamphlet just issued by the Joseph Dixon Crucible Company, Jersey City, N. J. The pamphlet is entitled, "Some Words of Wisdom About Paint, or the man that pays the bill and the man that owns the roof." The subject matter relates to Dixon's silica-graphite paint, which is especially adapted for tin, steel or shingle roofs, or any exposed surfaces, such as gutters, etc.

OSTRANDER CATALOGUE.—The revised catalogue of W. R. Ostrander & Company, 22 Dey Street, New York, has just been issued. It shows a complete line of general electrical supplies, including electric bell goods, electric light material, telephone and telegraph goods, bell-hangers' hardware, electricians' tools, etc. The catalogue is very completely illustrated, and any one interested in these lines will do well to secure a copy. The firm would like to hear from all requiring supplies of any kind in its line.

RESISTANCE WIRES.—The Driver-Harris Wire Company, 84 Mechanic Street, Newark, N. J., has just brought out a substantially bound catalogue on the subject of its "Climax" resistance wires. Tables give the properties of this wire, also prices. "Climax" resistance wire is said to have a high specific resistance and possesses strength and toughness in excess of the ordinary resistance wires. Besides the "Climax" wire, the company makes a wire of copper-nickel-alloy, which is named "Advance." It also makes German silver wire.

ASBESTOS.—The complete line of asbestos materials manufactured by the H. W. Johns Manufacturing Company, New York, is illustrated and described in a 62-page pamphlet just issued by that company. While the catalogue contains much of interest the cover itself is a notable feature, being made of asbestos. The illustrations show the different uses to which asbestos in some form or another is put, and at the back of the catalogue is a list and illustrations of some of the buildings, factories, etc., in which the company's asbestos materials have been applied.

DAMAGE TO ALUMINUM WORKS.—On Sunday, Aug. 12, a tornado struck the works of the Pittsburg Reduction Company, at New Kensington, Pa., and damaged the building to the extent of about $100,000. Two views of the damaged works published in a Pittsburg paper show that the tornado passed across the building, completely ruining the portion that lay in its path. The roof and walls were blown down, leaving a great gap in the structure. It is stated that the works will be shut down for some time in consequence of the damage done.

MESSRS. CHARLES H. BESLY & COMPANY, 10 and 12 North Canal Street, Chicago, Ill., report that they are receiving many orders from jobbers in New York, Boston, Providence, Pittsburg, Cleveland and Detroit for their steel parallel clamps. These clamps are very desirable for use on drill planers, milling machines and shapers. Recent shipments have been made of several complete shop equipments to the extreme Northwest, and several rush orders for Gardner grinders have been received from England. A copy of the firm's new catalogue will be sent free to any address upon application.

ELECTRIC MOTOR EQUIPMENT FOR PRINTING ESTABLISHMENTS.—The saving in power, economy of space, cleanliness and increased light obtained by the use of direct-connected motors in the press room is ably brought out in bulletin No. 200 of the Sprague Electric Company. The special advantages of using Lundell motors for this work on account of their efficiency, ability to stand overload, and economy in first cost and repair receive considerable attention in the pamphlet, and the pages are illustrated with numerous half-tones of various styles of motors and machines run by them.

A PROFITABLE POST OFFICE.—One of the most profitable post offices in the United States is that at Scranton, Pa. The volume of business is unusually large and is steadily increasing, the figures for the first six months of the present year showing more than double the business for the same months in 1893. This is due principally to the rapid growth of the International Correspondence Schools. Seven years ago the schools' postage was barely 5 per cent of the total, but now one-third of Scranton's postage is paid by the I. C. S. Their postage has increased from an average of less than $400 to over $5,000 a month.

EXHIBITS AT THE OHIO ELECTRIC LIGHT MEETING.—At the meeting of the Ohio Electric Light Association, at Toledo, there were many good exhibits of apparatus. One of the most prominent was the 2½-ampere miniature enclosed arc lamp, the product of the Lea Electric Manufacturing Company, Elwood, Ind. It is claimed that there is a demand for a more widely distributed service, and as two of these miniature lamps will take the current of an ordinary enclosed arc lamp it fills a long-felt want, and is a matter of economy from the consumer's standpoint. The Lea Company manufactures a full line of arc lamps, and its lamp is considered as equal to any on the market.

THE DEDION-BOUTON MOTORETTE COMPANY, of Thirty-seventh Street and Church Lane, Brooklyn, N. Y., has secured as its traveling representative Mr. C. G. Wridgway, champion automobilist. He is thoroughly posted on the engineering details of motor vehicle and cycle construction, and able to advise with the manufacturers of vehicles and cycles in reference to the details of construction and the use of the DeDion motor. He will start out on a trip from Albany and take in the territory through the Mohawk Valley, including Albany, Troy, Schenectady, Utica, Syracuse, Rochester, Buffalo, Dunkirk, Erie, Cleveland, and down through the carriage district of Ohio, and then either on to Chicago or back through Pennsylvania.

ELECTRIC HACK SAWS.—An example of the application of alternating-current motors to the driving of hack saws is described and illustrated in bulletin No. 3020, issued by the Emerson Electric Manufacturing Company, St. Louis, Mo. The illustration shows a hack saw driven by one of the Emerson alternating-current motors for 7200 alternations. This class of machine, while particularly useful in iron stores or blacksmith shops where steam-power is not used, will be found very convenient in fully equipped machine shops, since the outfit is entirely self-contained, and can be used in any location where is is possible to procure electric current for operating the motor. The catalogue contains considerable practical information on the general subject.

CREAM FLUX.—A new soldering flux is being put upon the market by the Cream Flux Company, 100 Washington Street, Chicago. The flux is in paste form, the formula having been tested for over a year before the flux was placed upon the market. It is claimed for it that it is the only absolutely non-corrosive soldering flux, containing no acid or elements injurious to good electrical connections. After an exhaustive test by the electrical department of the National Board of Fire Underwriters it has been approved. The Chicago Edison Company has made a thorough test of the flux, and reports that it meets all claims made for it. The same management that made Gale's Commutator Compound a success is managing the Cream Flux. Mr. M. J. Isaacs, manager of the company, states that besides being absolutely non-corrosive, this flux possesses the important merits of easy application, efficacy and cheapness. He also states that wiremen can make over double the number of joints in one-half the time with Cream Flux than with the same amount of other flux or salt.

VENTILATION.—An interesting study in methods of publicity and promotion is presented by the progress of the B. F. Sturtevant Company, of Boston, Mass., during the past few years. This company, devoting itself principally to the manufacture of blowers, has gradually evolved many special types designed for specific uses. It has not been deemed sufficient to merely advertise these types, but exhaustive study has been made of the conditions and best methods of application; special treatises have been prepared upon these subjects; purely educational articles regarding them have appeared in the technical press, and special illustrated lectures have been delivered before technical schools and societies. Some of these lectures, devoid of all reference to the B. F. Sturtevant Company, have been published for free distribution with gratifying results. Among recent publications are lectures by Walter B. Snow, of the engineering staff, entitled "The Influence of Mechanical Draft upon the Ultimate Efficiency of Steam Boilers," "Mechanical Ventilation and Heating by a Forced Circulation of Warm Air" and "The Application of Mechanical Draft to Stationary Boilers." Any one of these publications will be sent upon request.

LIGHTNING ARRESTERS.—The cost of a complete equipment of lightning arresters is negligible, compared with the value of the property which it protects. There is no security, however, if inefficient and unreliable arresters are employed, as they will either not act at all—allowing the insulation of the machines to be punctured—or the arc formed by the discharge will be maintained by the generator voltage and cause a burn-out. The lightning arresters manufactured by the General Electric Company are designed to offer less resistance than any other part of the circuit to the high potential discharge, but are so constructed as to either prevent or extinguish the arc that may be formed across the air-gaps of the arrester when simultaneous discharges occur on both sides of the circuit, or when the circuit has leaks to ground. In the direct current form the air-gap, across which the lightning discharges to reach the ground, is placed in a strong magnetic field, which repels the arc formed to a position on diverging terminals, when it can no longer be maintained. Dangerous arcs are prevented in the alternating current type by having the spark-gap between two slightly separated cylinders in series with high non-inductive carbon resistances. With the standard length of gap adopted, an alternating e. m. f. of 1000 volts cannot maintain an arc on this device, and for arresters to be used on higher potentials several cylinders with their spark-gaps in series are employed. In a lately issued catalogue and price list the General Electric Company points out the advantages to which attention is called above, and describes more in detail the operation of the apparatus, as well as giving instructions for its installation.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED AUG. 14, 1900.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

655,111. ELECTROLYTIC APPARATUS; A. Plecher, Savannah, Ga. App. filed Jan. 20, 1900.

655,703. DEVICE FOR REGISTERING ELECTRIC CURRENTS; V. G. Fuller, Toulon, Ill. App. filed Dec. 16, 1899. An electromagnet trips a gear train into operation, which continues as long as the current flows, the invention relating to the mechanical devices.

655,716. TELEGRAPHIC RELAY; I. Kitsee, Philadelphia, Pa. App. filed May 20, 1899. A conductor, supported by a dielectric material, is placed in proximity to a conductor carrying electric waves of high intensity such as is used in wireless telegraphy, so that the conductor will first be polarized, then attracted, and then repelled, these motions being made use of in a relay.

655,726. TELEPHONE RECEIVER, William J. Murdock, Boston, Mass. App. filed April 11, 1900.

655,747. ELECTRO-MEDICAL VACUUM APPARATUS; G. W. Winckfield, Alameda, Cal. App. filed Nov. 29, 1899. A vacuum cup composed of sections detachably connected and an electrode clamped between the sections.

655,762. INSULATED HANGER FOR ARC LAMPS; George Cutter, Chicago, Ill. App. filed May 4, 1900.

655,763. ANNUNCIATOR; William M. Davis, Chicago, Ill. App. filed Dec. 15, 1899.

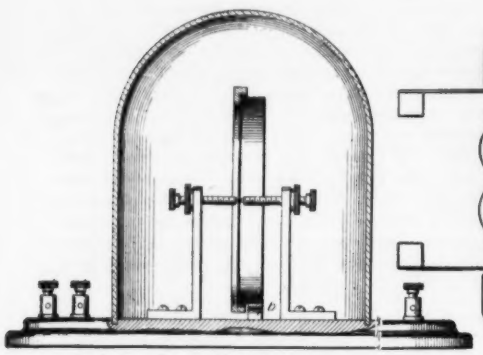
655,769. STORAGE BATTERY; G. A. Ford, Cleveland, Ohio. App. filed Sept. 5, 1895. The element consists of a porous pan and a conductor on the pan, each conductor having a series of vanes arranged at an angle and active material inserted between the vanes.

655,777. ELECTRICAL SIGN AND SIGNAL AND APPARATUS FOR OPERATING THE SAME; A. Heiny, San Francisco, Cal. App. filed Sept. 26, 1899. Details of construction of a sign-board having lamps on the surface, and a switch by which various combinations may be made to produce different characters on the sign.

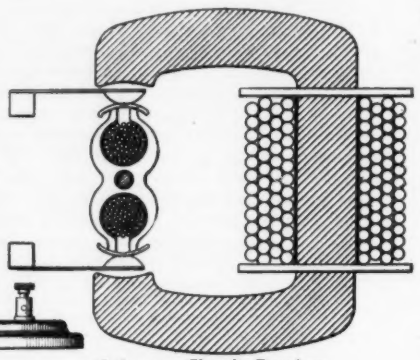
655,779. CONTROL OF ELECTRIC FURNACES; W. S. Horry, New York. App. filed Jan. 15, 1900.

655,780. ELECTRIC FURNACE; William Smith Horry, New York, N. Y. App. filed Aug. 15, 1899.

655,783. ELECTROLYTIC APPARATUS FOR DECOMPOSING METALLIC SALTS; C. Kellner, Vienna, Austria-Hungary. App. filed March 3, 1896. This invention has reference to an apparatus for the electrolysis of alkaline salts with the aid of a stationary mercury cathode, in which the amalgam formed by electrolytic action has its location changed from the decomposing chamber, in which it is produced, to a combining chamber, in which it is decomposed, and the cation combined with water, an acid, or other body by the shifting of a partition which is adapted to be moved to and fro in the mercury and serves to separate the two aforesaid chambers from each other.



655,716.—Telegraphic Relay.



656,105.—Circuit Breaker.

655,808. ELECTRIC ARC LAMP; Bernard A. Stowe, Cleveland, Ohio. App. filed July 10, 1899.

655,809. SIGNALING APPARATUS AND CIRCUIT THEREFOR; A. Stromberg and A. Carlson, Chicago, Ill. App. filed April 26, 1899. Consists of a magneto-generator, a magneto-bell and a switch automatically controlled by the operation of the generator for including the armature of the generator in circuit with the bell when signals are to be transmitted from a sub-station and to exclude the armature of the generator from circuit with the said bell by opening the circuit through the armature when the sub-station apparatus is to be placed in condition to receive signals.

655,810 and 655,811. TELEPHONE EXCHANGE SYSTEM; Alfred Stromberg and William H. Davis, Chicago, Ill. App. filed April 26, 1899.

655,824. BRUSH HOLDER; H. F. T. Erven and W. B. Potter, Schenectady, N. Y. App. filed Aug. 29, 1898. The holder comprises a rigid arm secured to a stud and carrying a holder for the brush, a spring for the brush and an adjusting device for the spring and means for relieving the tension of the spring without altering its adjustment.

655,838. METHOD OF INSULATING ELECTRIC CONDUCTORS; N. Tesla, New York, N. Y. App. filed June 15, 1900. (See page 287.)

655,849. TELEPHONE BELL CUT-OUT; L. F. Cobb, Providence, R. I. App. filed Jan. 6, 1900. For ringing an individual bell on party lines, a clockwork at each station is released and if retarded after a certain interval the bell at one station will ring, and if retarded after another interval the bell at another station will ring, and so on, using different intervals for different

655,852. ELECTRIC MOTOR; Patrick J. Collins, Scranton, Pa. App. filed Dec. 1, 1899. (See page 297.)

555,861. VENTILATOR; M. Gaul, Frankfort-on-the-Main, Germany. App. filed Sept. 23, 1899. A projection from the ventilator blades carries the armature of a solenoid, whose circuit is closed by a thermostat.

655,905. WIRE-JOINT AND METHOD OF MANUFACTURING SAME; F. W. Maxstadt, Chicago, Ill. App. filed June 11, 1900. The method consists in forming a double tubular sleeve out of a flat metal sheet, passing the wires into the tubes and then twisting them.

655,916. SYSTEM FOR INDIVIDUAL SERVICE ON ELECTRICAL PARTY LINES; W. Torst, Jr., Los Angeles, Cal. App. filed Sept. 25, 1899. Details.

655,920. MANUFACTURE OF CARBON; William J. Burke, Scranton, Pa. App. filed Dec. 16, 1899.

655,968. VOLTAIC CELL; E. M. Fishell, Cleveland, Ohio. App. filed Jan. 20, 1900. The carbon element consists of a disk having two cylinders projecting downward from it and provided with a closed passage connecting the inner chamber with the outer solution.

655,992. INDICATING DEVICE FOR TELEPHONE RECEIVERS; W. R. Rathvon, Florence, Colo. App. filed Nov. 28, 1899. A simple form of annunciator, which may be connected with the bell-hammer so that it will be released and its position changed when the bell rings, thus letting a person know whether the bell has rung during his absence.

656,004. AUTOMATIC RESISTANCE REDUCING DEVICE; G. H. Whittingham, Baltimore, Md. App. filed Dec. 4, 1897. A heavy current is passed through a solenoid for a compartively short time, sufficient to store power in a spring. The spring then gradually cuts out the resistance, the first movement serving to cut off the heavy current from the solenoid.

656,011. LOCK; H. G. Carleton, New York, N. Y. App. filed Nov. 15, 1899. Details.

656,012. ELECTRIC LAUNCH; Jacob C. Chamberlain, New York, N. Y. App. filed March 27, 1899. (See Current News and Notes.)

656,029. ELECTRIC AUTOMATIC CONTROLLER AND INDICATOR FOR RAILROADS; V. Leto, Newark, N. J. App. filed Sept. 14, 1899. An attachment for locomotives for showing the distance traveled.

656,030. TROLLEY FOR ELECTRICALLY DRIVEN VEHICLES; L. Lombard-Gerin, Lyons, France. App. filed Jan. 9, 1900. An automotor-trolley comprising an apparatus provided with a shaft having contact-rollers adapted to travel on conductors insulated one from another and said apparatus having a motor possessing a fixed inductor and a movable armature, the periphery of which directly actuates friction-rollers on the shaft of the contact-rollers.

656,076. METHOD OF ELECTROSTATICALLY MEASURING CURRENTS IN WORKING CIRCUITS; G. L. Addenbrooke, London, England. App. filed May 7, 1900. The method consists in electrostatically measuring electric currents in a working circuit by connecting an electrostatic wattmeter, voltmeter and ammeter to the circuit and taking deflection readings therefrom under working conditions upon suitable scales, then calibrating the instruments by means of a suitable standard cell, ratio resistance, battery and readings upon the said scales adjusted for direct reading, and finally reproducing the original deflections upon the scales so adjusted and ascertaining their value directly.

656,077. MANUFACTURE OF INCANDESCENT MATERIALS FOR ELECTRIC LIGHTING; George Alefeld, Darmstadt, Germany. App. filed June 15, 1899.

656,095. PLATE FOR SECONDARY BATTERIES; John Bell Conrad, Chicago, Ill. App. filed March 9, 1900. (See page 298.)

656,100. ELECTRICITY METER; P. Eibig, Berlin, Germany. App. filed Jan. 20, 1900. The meter contains a motor having an oscillating armature and a motor having a rotating armature.

656,105. CIRCUIT BREAKER; E. W. Garrett, Johnstown, Pa. App. filed Dec. 1, 1899. Consists of a circuit breaker whose movable contacts are carried by a member placed in a magnetic field and itself capable of generating a field whose lines do not coincide in direction with those of the field in which the member is placed, and means for restraining the movement of the member under normal conditions.

656,115. INCANDESCENT LAMP; C. Hoelscher, Warren, Ohio. App. filed April 30, 1900. Simple devices for switching one or more filaments into circuit.

656,125. BOND FOR TRACK RAILS; H. F. A. Kleinschmidt, Johnstown, Pa. App. filed Dec. 28, 1899. The end of the bond is seated in a block and then welded thereto.

656,127. DYNAMO-ELECTRIC MACHINE; J. D. Spence, Somerville, Mass. App. filed May 12, 1899. The inventor employs a coil surrounding a magnetic shunt for the purpose of reducing the weakening effect of the shunt as the machine attains its normal speed, and a neutralizing coil to counteract the effect of the first-named coil as the machine exceeds its normal speed.

656,128. METHOD OF REGULATING DYNAMO-ELECTRIC MACHINES; J. D. Spence, Somerville, Mass. App. filed May 12, 1899. Covers the method practiced in the use of the machine described in the preceding patent.

656,156. METHOD OF PRODUCING CARBIDE OF CALCIUM; W. S. Horry, New York, N. Y. App. filed March 4, 1899. (See Current News and Notes.)